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INDIA TROPICAL FOREST & BIODIVERSITY ANALYSIS (FAA 118/119)

June 2012

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Table of Contents

Abbreviations and Acronyms	iii
1. EXECUTIVE SUMMARY	1
1.1 Objective of Analysis and Type of Analysis	1
1.2 Threats and Universe of Actions needed to conserve Biodiversity and Forests.....	1
1.3 Conservation Linkages with USAID/India Development Objectives	1
1.4 Impact of relevant USAID/India programs on Forests and Biodiversity Conservation	2
1.5 USAID/India Interventions in the Forestry/ Biodiversity Sector	2
2. INTRODUCTION	4
2.1 Purpose	4
2.2 Methodology	5
3. BIOPHYSICAL STATUS OF BIODIVERSITY AND TROPICAL FORESTS IN INDIA	6
3.1 Scope of Biodiversity in Analysis.....	6
3.2 Introduction to India's Biodiversity and Tropical Forests	6
3.3 Ecosystem Diversity	8
3.4 Species Diversity	13
3.5 Genetic Diversity.....	13
4. SOCIAL, ECONOMIC, AND POLITICAL CONTEXT OF CONSERVATION	16
4.1 Social and Economic Context.....	16
4.2 Political Context.....	17
4.3 Laws, Policies, and Institutions Affecting Conservation	18
4.4 National Protected Area System.....	20
4.5 Participation in International Treaties/Agreements.....	23
5. THREATS AND UNIVERSE OF ACTIONS NEEDED TO CONSERVE BIODIVERSITY AND FORESTS	24
6. SUMMARY OF GOVERNMENT, DONOR, AND NGO PROGRAMS AND ACTIVITIES	32
6.1 Government Programs and Activities.....	32
6.2 Donor Supported Programs and Activities	38
6.3 Non-Governmental Organizations (NGO) Program and Activities.....	41
7. LINKAGES OF USAID/INDIA DEVELOPMENT OBJECTIVES WITH FORESTRY AND BIODIVERSITY CONSERVATION	43
7.1 Identification of Opportunities for Conservation Linkages.....	43
7.2 Conservation Linkages	43
8. IMPACT OF RELEVANT USAID/INDIA PROGRAMS ON FORESTRY AND BIODIVERSITY CONSERVATION	50
9. USAID/INDIA INTERVENTIONS IN THE FORESTRY/ BIODIVERSITY SECTOR	54
9.1 Partnership for Land Use Science (Forest-PLUS)	54

9.2	US Forest Service PAPA.....	55
9.3	Other Forestry Programs/Activities	56
9.4	Cross-border Tiger Conservation	56
9.5	Water	56
9.6	Clean Energy	56
Appendix A : Introduction to Ecosystem Services and Values of Biodiversity and Forests.....		59
Appendix B : List of Wetlands of International Importance in India (Ramsar Sites).....		61
Appendix C : Map of Forest Cover of India (2011)		62
Appendix D : Map of Forest Cover of India by Forest Type (2011)		63
Appendix E : Map of tiger reserves in India		65
Appendix F : Recorded Plant and Animal Species in India		66
Appendix G : List of Critically Endangered Species in India.....		68
Appendix H : Agricultural Biodiversity - List of wild relatives of crop plants and native breeds of domesticated animals		70
Appendix I : Multilateral Environment Agreements Ratified by India		71
Appendix J : List of Principal Laws and Policies Affecting Conservation in India		72
Appendix K : List of Institutions Affecting Conservation in India		75
Appendix L : Biodiversity Hotspots in India		79
Appendix M : RDMA 118/119 Analysis (2012): Take-Home Messages Regarding India		80
Appendix N : Bibliography		83

Abbreviations and Acronyms

ADS	Automated Directives System
CBD	Convention on Biological Diversity
CDCS	Country Development Cooperation Strategy
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CZMP	Coastal Zone Management Plan
DO	Development Objective
FAA	Foreign Assistance Act
FAO	Food and Agriculture Organization of the United Nations
FD	Forest Department
Forest-PLUS	Partnership for Land Use Science
FSN	Foreign Service National
GAP	Ganga Action Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIM	Green India Mission
GOI	Government of India
INGO	International NGO
IR	Intermediate Result
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
LEDS	Low Emissions Development Strategies
MAB	UNESCO Man and Biosphere Programme
MDG	Millennium Development Goals
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
MPA	Marine Protected Area
NAP	National Afforestation Program,
NBA	National Biodiversity Authority
NBAP	National Biodiversity Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non Governmental Organization
NTFP	Non Timber Forest Products
PA	Protected Area
PACE-D	Partnership to Advance Clean Energy - Deployment

REDD	Reducing Emissions from Deforestation and forest Degradation
SOW	Scope of Work
TEEB	The Economics of Ecosystems and Biodiversity
TERI	The Energy and Resources Institute
UNCCD	UN Convention to Combat Desertification
UNCSD	United Nations Conference on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WAISP	Water Analysis, Innovations, and Systems Program
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WII	Wildlife Institute of India
WWF	World Wildlife Fund for Nature

1. EXECUTIVE SUMMARY

1.1 Objective of Analysis and Type of Analysis

During spring of 2012, USAID/India commenced the process of developing its five-year Country Development Cooperation Strategy (CDCS) for the period 2013-2017. This Tropical Forest and Biodiversity Analysis, conducted in tandem with and as part of the explicit analytical agenda of the strategy formulation, has the objective of assisting USAID/India define how its proposed five-year country strategy contributes to conservation needs. This also serves as an instrument to guide the integration of forestry and biodiversity concerns into proposed programs in the short and medium term.

In accordance with the FAA and country strategy guidelines under ADS 201 and ADS 204, the purpose of this analysis is three-fold:

- (i) The current state of biodiversity and tropical forests in India
- (ii) The actions necessary to conserve tropical forests and biological diversity in India, and
- (iii) The extent to which the current and proposed actions of USAID/India meet or could meet the needs identified

1.2 Threats and Universe of Actions needed to conserve Biodiversity and Forests

The threats to forests and biodiversity are categorized as direct threats (attributable to the immediate destruction of biological diversity, including tropical forests) and indirect threats (contributing to the direct threats). The direct threats include (i) Habitat Loss – fragmentation, degradation and loss, shrinking genetic diversity; (ii) Over-exploitation of resources and declining forest resource base; (iii) Invasive alien species; (iv) Climate Change; (v) Impact of pollution; (vi) Gaps in Biodiversity information base; and (vii) Unknown impact of emerging biotechnologies. The indirect threats include (i) Undervaluation of Ecosystem Services; (ii) Fragmented Institutional framework: Enhancements needed to policy, legal and administrative measures; (iii) Impact of development projects: Convergence of economic and social transformation amplified by population.

The actions necessary to address the direct threats include (i) Strengthening and integration of *in situ*, on-farm and *ex situ* conservation; (ii) Augmentation of natural resource base and its sustainable utilization, ensuring inter and intra-generational equity; (iii) Regulation of introduction of invasive alien species and their management; (iv) Assessment of vulnerability, and adaptation to climate change and desertification; (v) Minimizing pollution impacts; (vi) Development and integration of biodiversity databases; and (vii) Building of national capacities for biodiversity conservation and appropriate use of new technologies. The actions to address the indirect threats include (i) Valuation of goods and services provided by biodiversity and use of economic instruments in decision making processes ;(ii) Strengthening implementation of policy, legislative and administrative measures for biodiversity conservation and management; and (iii) Integration of biodiversity concerns in economic and social development.

1.3 Conservation Linkages with USAID/India Development Objectives

1.3.1 Climate Change

Ecosystems are not only affected by climate change but also affect the climate – conserved or restored habitats can remove carbon dioxide from the atmosphere, thus helping to address climate change by

storing carbon (for example, reducing emissions from deforestation and forest degradation). Similarly, just as climate change may be characterized as an additional stressor on biological systems, the carbon mitigation value of natural systems is a service provided by ecosystems. In the proposed strategy, the Climate Change DO is limited to the mitigation dimension of climate change.

1.3.2 Food Security

The Food Security DO's strategic focus on the human and academic understanding of food security and its related components, including natural resource management, is very timely and addresses an area of need identified in the conservation needs assessment. Of particular relevance to conservation of biological diversity and forest resources would be advancement of the science and application around the integrated agro-ecosystems, use of agroforestry systems, the carbon-water-nutrient cycling, and incorporation of climate variability in crop and farm planning and management.

1.3.3 Health

Under its health systems strengthening activities, the Health DO may consider a comprehensive approach to ecosystem health and human health that integrates or optimizes across each of the dimensions below or select those areas most aligned across the portfolio as a whole as a near-term starting point (perhaps nutrition, fuel, disease vector spread and management of wild species used in traditional medicines).

1.4 Impact of relevant USAID/India programs on Forests and Biodiversity Conservation

Of the 46 active USAID/India programs/activities, 23 continue beyond September 2012. In addition there are 11 programs/activities that are in the pipeline and expected to be awarded by September 2012. The Initial Environmental Evaluation (IEE) of these 34 (23 ongoing + 11 pipeline) programs/activities was reviewed with the Mission Environmental Officer (MEO). In addition to that discussions were also held with the relevant technical offices and contracting office. Of all the 34 programs/activities, only six appear to have significant linkages with forestry and biodiversity. Although those six programs/activities have the potential, there is very little risk of significant negative impacts on forests and biodiversity conservation. The MEO along with the technical offices will closely monitor these projects to assess the impacts on forests and biodiversity during the implementation of the projects. If any of the projects are found to have any significant impacts, Environmental Monitoring and Mitigation Plan (EMMP) will be developed and the relevant training will be provided to the implementation partners.

1.5 USAID/India Interventions in the Forestry/ Biodiversity Sector

1.5.1 Partnership for Land Use Science (Forest-PLUS)

Forest-PLUS program aims to reduce emissions and enhance carbon sequestration through India's forests by taking REDD+ actions to scale. USAID will work in close collaboration with the Ministry of Environment and Forests (MoEF) of the Government of India, local governments, and local communities. The program is divided into 2 components. Component one focuses on U.S.-India collaborative scientific research and exchanges that explore methods and approaches to implement REDD+. This will be vital for India's own programs and will further demonstrate India's advances in science and technology to develop lessons that may be applied in other developing countries. Under component two, cost-effective, geographically relevant and culturally appropriate methods and approaches will be piloted in the field at scales that lend the results and learning to replication at higher levels. These efforts to improve carbon

sequestration from forests also benefit forest conservation at large and the biodiversity it contains within. For examples, most of the large forested landscapes in India are tiger habitats, and conservation of these forest landscapes would help in conservation of tigers and other species down the food chain.

1.5.2 US Forest Service PAPA

USAID's interagency agreement with USFS builds upon scientific and technical collaboration and exchange envisioned under USAID's Forest-PLUS program. This five-year activity also builds upon previous and ongoing work being undertaken by USFS in forestry sector in India. Phase 1 focuses on conducting trainings to bolster Indian expertise in completing carbon estimations, forest inventories, and related analyses. Phase 2 focuses on setting up pilot projects to demonstrate methodologies, tools and technologies in Indian context.

1.5.3 Other Forestry Programs/ Activities

USAID will invest a part of the GCC funds into a new grant that advances development innovations in the forestry sector. As currently envisioned, this mechanism will create a platform to support scientific research on valuation of ecosystems services. This grant may be modeled on the new agency-wide platforms such as prizes or research-oriented grants such as the Partnerships for Enhanced Engagement in Research (PEER) program. The research will enhance GOI's understanding of ecosystem services, and subsequently facilitate the long-term implementation of payments for ecosystems services.

1.5.4 Cross-border Tiger Conservation

USAID/India is exploring opportunities for cross border tiger conservation (India and Bangladesh) with funding from the Asia Regional Bureau.

1.5.5 Water

To promote climate change adaptation and water sustainability while improving farmer livelihoods and food security, USAID is starting a Water- Agriculture-Livelihood Security project in India. The project would develop a public-private partnership to provide modern extension services to farmers for climate and market informed crop choice and irrigation improvements to improve water productivity, increase income, and promote climate-risk management.

1.5.6 Clean Energy

USAID/India clean energy programs look into improving use and efficiency of biomass based energy technologies. USAID/India is supporting work in promoting advanced cook stoves by rural communities to improve indoor air pollution through more efficient fuel consumption (largely biomass). PACE-D program will support approaches to overcome barriers to rural electrification and decentralized RE generation. Biomass based RE technologies are the most predominantly used technologies for rural electrification. The Microfinance Support program under PACE-D will enhance capacity of MFI's in providing energy services to underserved rural areas.

2. INTRODUCTION

2.1 Purpose

2.1.1 Objective of Analysis and Type of Analysis

During spring of 2012, USAID/India commenced the process of developing its five-year Country Development Cooperation Strategy (CDCS) for the period 2013-2017. This Tropical Forest and Biodiversity Analysis, conducted in tandem with and as part of the explicit analytical agenda of the strategy formulation, has the objective of assisting USAID/India define how its proposed five-year country strategy contributes to conservation needs. This also serves as an instrument to guide the integration of forestry and biodiversity concerns into proposed programs in the short and medium term.

In addition to optimizing the strategy to meet conservation needs, Sections 118 (Tropical Forests) and 119 (Biological Diversity) of the U.S. Foreign Assistance Act (FAA) require USAID Missions to examine issues related to tropical forest and biodiversity conservation as part of each country development strategy or country plan. In accordance with the FAA and country strategy guidelines under ADS 201 and ADS 204, the purpose of this analysis is three-fold:

- (i) The current state of biodiversity and tropical forests in India
- (ii) The actions necessary to conserve tropical forests and biological diversity in India, and
- (iii) The extent to which the current and proposed actions of USAID/India meet or could meet the needs identified.

Language from Foreign Assistance Act of 1961 as Amended:

Sec. 118 Tropical Forests

(e) COUNTRY ANALYSIS REQUIREMENTS — Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of—

- (1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests, and
- (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

Sec. 119 Endangered Species

(d) COUNTRY ANALYSIS REQUIREMENTS — Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of—

- (1) the actions necessary in that country to conserve biological diversity, and
- (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

2.1.2 Importance of Analysis to Strategy Formulation

USAID has recently re-launched the development of country strategies for development, termed Country Development Cooperation Strategy (CDCS). The most recent strategy for India was the Country Strategic Plan for 2002-2007 with the most recent Tropical Forest and Biodiversity Analysis to inform said strategy finalized in 2001. As over 10 years have passed and the Indian landscape has evolved significantly, particularly in terms of the legal and policy landscape, the emergence of climate change as a key stressor on biodiversity and forests, and India's unprecedented economic and social transition, this report provides a re-evaluation of the actions necessary and strategic opportunities of USAID/India to support conservation and sustainable management of biodiversity and forests.

2.1.3 Timing and Dates of Analysis relative to Strategy Development

The Tropical Forests and Biodiversity Analysis was conducted in the spring of 2012. This was ideal timing since the USAID/India Mission was simultaneously drafting its Results Framework paper for the CDCS over this period and the proposed strategy was detailed enough to allow for meaningful analysis but not "set in stone" so that the analysis could serve as a useful input to the strategy's analytical agenda and potentially inform the final strategy. The timing of the strategy development and this analysis is also opportune as much of the Mission's portfolio has been overhauled or in is a state of transition. With six new partnership (bilateral) agreements at the Ministerial level signed in 2010 and almost across the board activities still in the procurement phase or just starting to commence activities, the Mission's portfolio is in some respects at ground zero, enabling the opportunity to look holistically for opportunities to streamline conservation into the Mission's portfolio.

2.2 Methodology

The approach used was primarily a "desk assessment" since India is quite advanced in its documentation, analysis and legal basis for biodiversity conservation and forest management. Despite being conducted as a desk assessment, this analysis follows USAID good practice guidance for the conduct of Tropical Forestry and Biodiversity Analyses^{1, 2} and covers all relevant and required sections including an overview of the biophysical status of biodiversity and forest resources, the economic, social, political context of conservation, followed by a narrowing in on the threats and actions needed for conservation. During the information-gathering phase, a thorough literature review of available information including published materials and information available on the Internet on biodiversity conservation, forest resources and forest management in India was carried out.

¹ USAID, 2005, Tropical Forestry and Biodiversity (FAA 118 and 119) Analysis: Lessons Learned and Best Practices from Recent USAID experience (2005).

² USAID, 2005, Best Practices for Biodiversity and Tropical Forest Assessments, April 2005

3. BIOPHYSICAL STATUS OF BIODIVERSITY AND TROPICAL FORESTS IN INDIA

3.1 Scope of Biodiversity in Analysis

Biodiversity as defined in the “Biodiversity Conservation: A Guide for USAID Staff and Partners” (USAID, 2005) is *“the variety and variability of living organisms. The Earth’s biodiversity consists of genes, species, and ecological processes making up terrestrial, marine and other aquatic ecosystems that both support and result from this diversity. All of these elements of living systems interact with each other to produce the web of life on Earth—the biosphere—a whole much greater than the sum of its parts”*³. While biological diversity can be comprehended at multiple levels, such as communities and populations, or at the level of biomes, bioregions, landscapes, habitats and niches as well as nucleotides, genes, chromosomes, individuals and even populations, for the purposes of this analysis biological diversity is considered at three basic levels. These three levels are considered the most meaningful and relevant for the purposes of USAID/India’s strategic planning and scale of possible impact.

- **Ecosystem diversity** is the variety of different ecosystems, which comprises both living and non-living components, and the ecological complexes of which they are a part, in terrestrial, marine and other aquatic environments. This report will discuss freshwater, coastal, marine, and forest ecosystems.
- **Species diversity** refers to differences between species, and is the variety of life forms on earth, both domesticated and wild. This report will highlight Threatened and/or Endangered Species as an important subset of species.
- **Genetic diversity** indicates genetic variability within a species, and is the basis of difference between individuals of a single species. Agricultural diversity will be looked at as a special subset of genetic diversity.

The **mega-diversity** concept was created by Conservation International in an attempt to prioritize conservation efforts around the world and is based on the total number of species in a country and the degree of endemism at the species and higher taxonomic levels. The mega-diverse countries include Australia, Brazil, China, Colombia, Democratic Republic of the Congo (DRC), Ecuador, India, Indonesia, Madagascar, Malaysia, Mexico, PNG, Peru, the Philippines, South Africa, the United States, and Venezuela. Together, these 17 countries harbor more than 70% of the earth's species.

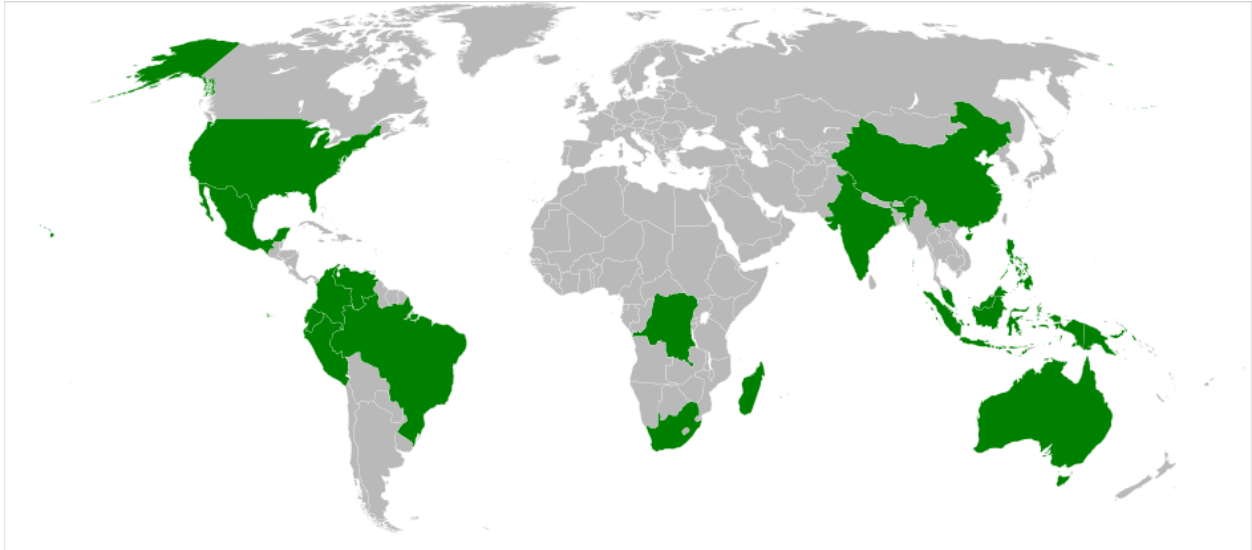
3.2 Introduction to India’s Biodiversity and Tropical Forests

India is one of the 17 mega-diverse countries of the world. With only 2.4% of the world’s land area, India accounts for 7-8% of the recorded species of the world that have been documented so far. India is the seventh largest country in terms of area. This sheer scale, complemented by India’s wide variety of physical features and climatic conditions, has resulted in a rich diversity of habitats and ecosystems such

³ Biodiversity Conservation: A Guide for USAID Staff and Partners” (USAID, 2005)

as forests, grasslands, mountains, wetlands, coastal and marine (mangroves and coral reefs) and deserts. These habitats and ecosystems, in turn, support India's notable biological diversity, having already documented over 91,000 species of animals and 45,500 species of plants in its ten biogeographic regions (NBAP 2008; Biodiversity Act, 2002). Of these, several thousand are endemic to the country. Bamboo in India constitutes the largest bamboo resources in the world. Mangroves in India contribute 5% of the total mangrove resources of the world.

Map indicating 17 countries identified as mega-diverse by Conservation International



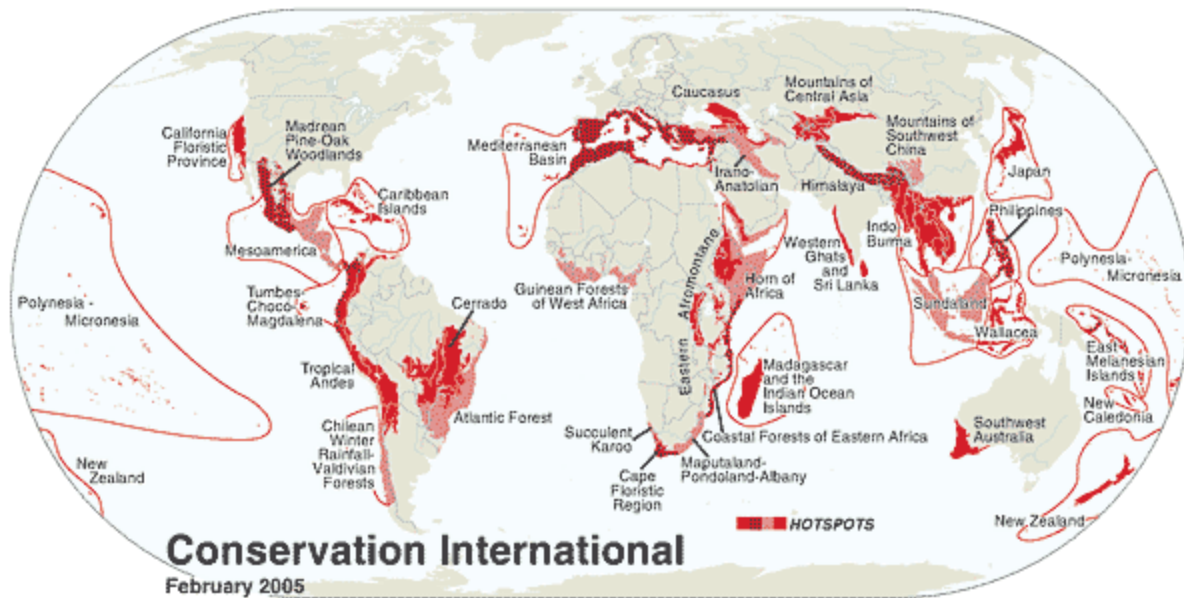
Biodiversity Hotspots: Closely related to India's status as a mega-biodiverse country is the fact that India completely houses two of the planet's 34 biodiversity hotspot in the world – Western Ghats and Eastern Himalayas and the third - Indo-Burma - lies partially within the Indian North-East.

British ecologist Norman Myers defined the biodiversity "hotspot" concept in 1988 to help conservationists determine what areas are the most immediately important for conserving biodiversity. The biodiversity

hotspots hold especially high numbers of endemic species, yet their combined area of remaining habitat covers only 2.3 percent of the Earth's land surface. Each hotspot faces extreme threats and has already lost at least 70 percent of its original natural vegetation. Over 50 percent of the world's plant species and 42 percent of all terrestrial vertebrate species are endemic to the 34 biodiversity hotspots.

A **biodiversity hotspot** is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans. To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot-map, a region must meet two strict criteria:

- contain at least 0.5% or 1,500 species of vascular plants as endemics, and
- have lost at least 70% of its primary vegetation.



Map indicating Biodiversity Hotspots, including Western Ghats, Eastern Himalayas and Indo-Burma lying in Indian Territory

3.3 Ecosystem Diversity

3.3.1 Geography and Climate

India is the seventh-largest country in the world, with a total land area of 3,287,263 square kilometers (1,269,219 sq. mi) and measures 3,214 km (1,997 mi) from north to south and 2,993 km (1,860 mi) from east to west with a coastline of 7,517 km (4,671 mi). The topographical diversity over India's extensive geography coupled with varied precipitation constitutes a rich landscape and ecological diversity that makes India as one of the mega-diverse regions on the globe.

Climate: Given the country's wide latitudinal spread which permits a wide range of variations in temperature and diverse topography and landscapes, it has high climate variation including areas with high rainfall such as Meghalaya in the northeast, dry areas of western Rajasthan with negligible rain, the hot and humid southern peninsula, and the snowbound Himalayan Mountains. The climate of India is dominated by the Asiatic monsoon, most importantly by rains from the southwest between June and October, and drier winds from the north between December and February. From March to May the climate is dry and hot.

3.3.2 Wetlands

India has a rich variety of wetland habitats. The total area of wetlands (excluding rivers) in India is 58,286,000 ha, or 18.4% of the country, 70% of which comprises areas under rice paddy cultivation. A total of 1,193 wetlands, covering an area of about 3,904,543 ha, were recorded in a preliminary inventory coordinated by the Department of Science and Technology, of which 572 were natural (Scott, 1989). India has 25 Wetlands of International importance (Ramsar Sites) totaling 677,131 hectares.

3.3.3 Coastal and Marine Biodiversity

India's extensive coastline is spread across 10 coastal States and seven Union Territories, including the islands of Andaman and Nicobar, and Lakshadweep. There are three gulfs significant for biological diversity -- one on the east coast (Gulf of Mannar) and two on the west coast (Gulf of Kutch and Gulf of Kambath). The two island ecosystems Lakshadweep and Andaman and Nicobar Islands add to the ecosystem diversity in India. The marine ecosystem is extremely diverse, attributed to the geomorphologic and climatic variations along the coast. The coastal and marine habitat includes nearshore, gulf waters, creeks, tidal flats, mud flats, coastal dunes, mangroves, marshes, wetlands, seaweed and sea grass beds, deltaic plains, estuaries, lagoons and coral reefs. The east coast of India, extending from the international border of India and Bangladesh in the northeast, includes the states of West Bengal, Orissa, Andhra Pradesh, and Tamil Nadu, acts as the recipient of mighty rivers of the Indian subcontinent including the Ganga and Brahmaputra. These areas are important for the marine fisheries as they serve as nurseries for many species of shellfish and fin fish.

Ramsar Wetlands of International Importance: The Ramsar Convention on Wetlands is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. It is the only global environmental treaty that deals with a particular ecosystem. The Convention's member countries have committed themselves to:

- work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education;
- designate suitable wetlands for the List of Wetlands of International Importance ("Ramsar List") and ensure their effective management; and
- cooperate internationally concerning transboundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands.

Coral Reefs: Coral reefs occur along only a few sections of the mainland, principally the northwest Gulf of Kutch, which has some of the most northerly reefs in the world, and in the Gulf of Mannar in the southeast. The general absence of coral reefs on the mainland is due largely to the presence of major river systems and the sedimentary regime on the continental shelf. In addition, the Andaman and Nicobars have fringing reefs around many islands, and a long barrier reef (329 km) on the west coast.

Mangroves: Mangrove forms one of the most extraordinary ecological formations occurring almost exclusively in the tropics. Mangrove ecosystems are found along both the east and west coasts of India, covering an estimated area of 4,120 sq. km. India's east coast is endowed with the world's largest mangrove forest, the Gangetic Sunderbans in West Bengal.

Seagrass beds: Seagrasses occur in the infratidal and midtidal zones of shallow and sheltered localities of sea, gulf, bays, backwaters and lagoons. They are submerged monocotyledonous plants and adapted to the marine environment for completion of their life cycle under water. Seagrass beds are found along the coasts of Tamil Nadu, Lakshadweep Islands, Andaman and Nicobar Islands, and the Sundarbans.

There are 770 species of seaweeds found in shallow waters all along the Indian coast, particularly in Tamil Nadu, Gujarat, Goa, Maharashtra and Lakshadweep. Although not directly exploited, seagrass is valuable as habitat for several species of marine turtle as well as commercially harvested species such as the green tiger prawn (*Penaeus semisulcatus*).

Marine Species: Five species of marine turtles are found in Indian waters: leatherback turtles (*Dermochelys coriacea*), green turtles (*Chelonia mydas*), olive ridleys (*Lepidochelys olivacea*), hawksbills (*Eretmochelys imbricata*), and the loggerhead (*Caretta caretta*). The three mass-nesting sites on the east coast of India—Gahirmatha, Rushikulya and Devi river mouth—are all in the State of Orissa. Most of the marine turtle populations found in the Indian region are in decline due to deliberate human predation. Twenty-five species of marine mammals (Cetaceans and Sirenias) are found in Indian waters. Sea cows (*Dugong dugon*), for example, are found in the waters off the Gulf of Mannar, the Gulf of Kutch, and the Andaman and Nicobar islands.

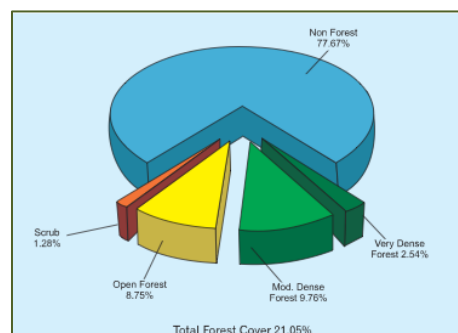
Estuaries: Estuaries are an integral part of coastal environment. India's coast is indented by a number of rivers, which form estuaries at their confluence with the sea, creating a transitional zone between the fluvial and marine environs. As estuaries are semi-enclosed and sheltered coastal bodies of water, are effective nutrient traps and harbor rich biological diversity.

Coastal lagoons: Coastal lagoons are shallow coastal water bodies separated from the ocean by a barrier, connected at least intermittently to the ocean by one or more restricted inlets and usually oriented parallel to shore. The ocean entrance(s) can at times be closed off by sediment deposition as a result of wave action and littoral drift. A number of lagoons are present on the east and west coast of India, including 17 noteworthy lagoons.

3.3.4 Forest Ecosystems

India's forests are classified into four major groups - tropical, subtropical, temperate, and alpine. These major groups are further divided into 16 type groups: Tropical (wet- evergreen, semi-evergreen, moist deciduous, littoral and swamp, dry deciduous, thorn, dry evergreen), sub-tropical (broad leaved hill forests, pine, dry evergreen), temperate (montane wet, Himalayan moist temperate, Himalayan dry temperate), and alpine (sub-alpine, moist alpine, and dry alpine scrub). Of the 16 forest types, tropical dry deciduous forests are the predominant type (38.2%), followed by tropical moist deciduous forests, which forms 30.3% of the total forest area of the country.

The Forest Survey of India conducts a biennial mapping of Indian Forests. Indian forest cover is classified in categories based on the percentage of tree canopy. See Appendices for Table of Forest Cover by Type and Map of Forest Cover. An estimated 21% of India's territory has tree cover. Of this total, only 2.54 percent has a dense canopy (70% and above), while the predominant areas as state-designated forests may be considered degraded with relatively open canopies, which is an indication of degradation pressure.



Forest Class	Definition	Percent of Geographic Area
Very Dense Forests	Tree canopy of 70% and above	2.54
Moderately Dense	Tree canopy between 40 and 70%	9.76
Open Forest	Tree canopy between 10 and 40%	8.75
Scrub	Degraded forest lands with canopy less than 10%	1.28
Non-forest	Area not included in the above classes	77.67

Source: India State of Forest Report 2011

The status of forest cover of India during the period 1987 to 2011 based on the earlier assessments by the Forest Survey of India (FSI) is given below:

Year of Assessment	Forest Cover Area (in sq km) and (% of total geographical area)
First- 1987	640,819 (19.49%)
Second- 1989	638,804 (19.43%)
Third- 1991	639,364 (19.45%)
Fourth- 1993	639,386 (19.45%)
Fifth- 1995	638,879 (19.43%)
Sixth- 1997	633,397 (19.27%)
Seventh- 1999	637,293 (19.39%)
Eighth- 2001	653,898 (19.89%)
Ninth- 2003	677,816 (20.62%)
Tenth- 2005	690,171 (20.60%)
Eleventh- 2009	690,899 (21.02%)
Twelfth- 2011	692,027 (21.05%)

India's forests support a rich collection of biological diversity, provide a range of products and ecosystem services, and support over 200 million rural people who depend on forests for their livelihoods. Even though forestry is the second largest land use in India after agriculture, covering approximately 23.57 percent (recorded forest area) of the total geographical area, the contribution to the Gross Domestic Product (GDP) from forestry is minimal at barely 1.1 percent in 2001 when calculated based on the traditional economic activities (logging, transportation of forest products to the sale depots/ assembly centers, and farmyard wood) (NBAP 2008, GIST 2006). However, in recent years there has been growing awareness around the world of the role played by forests in providing important environmental services such as carbon sequestration, biodiversity conservation and watershed protection, food provision, disaster mitigation, and livelihoods benefits. The GIST 2006 Forestry study confirmed the conclusions of other earlier works that the economic value added by forestry is in fact much higher and markets for these services. This presents the prospect of generating real payments for forest owners and managers in many cases poor communities, providing them with increased incentives to maintain forests. Reducing Emissions from Deforestation and Forest Degradation (REDD) represents one of the most promising initiatives to catalyze a global market for carbon offsets from the forestry sector.

There is a close relationship between forest ecosystems and watershed services. Forests also comprise some of the most important watersheds and play an important role in the conservation of soil and water

resources primarily by protecting the soil against erosion, and maintaining the quantity and quality of water. Natural forest vegetation protects the soil from splash erosion by intercepting rainfall, dissipating droplet energy, and protecting the surface with a covering of leaf litter. Due to forest vegetation, rainfall infiltration is increased and surface runoff and soil erosion reduced. Natural forests stabilize ground water levels and stream flows. While there is much global emphasis on the possibility of trading carbon sequestration services from forests, these watershed protection services are perhaps the most valuable of forest environmental services in India. Increased variability in the timing and quantity of precipitation induced by climate change is expected to exacerbate water scarcity in many parts of the country. The protection services provided by watersheds, such as regulation of water flows, improved water quality, and control of soil erosion, can play an important role in improved resilience and adaptation to changing conditions.

3.3.5 Mountain Ecosystems

The major mountain ranges in India are the Himalaya, the Western Ghats, the Eastern Ghats, and the Aravallis. The Himalaya stretches to about 3,000 km in length and varies from 220 to 300 km in width. The Indian Himalayan region is spread over the states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, a part of Assam, and one district of West Bengal. The area can be divided into four distinct zones longitudinally (i) the Siwalik (900 – 1500 m), (ii) the outer Himalaya (1500 – 3500 m), (iii) the middle or lesser Himalaya (3600 – 4600 m), and (iv) the Greater Himalaya (above 4,600 m). This complex mountain system consists of narrow and deep valleys, glaciers, grasslands, forests and fertile terrain.

The natural grasslands in the Himalaya are represented by alpine meadows. These systems are widely distributed between tree line and snow line habitats from extremely dry trans/ north west Himalaya to humid east Himalaya. In view of the variations in structure / composition of biodiversity elements in response to climatic conditions two types of alpine grassland ecosystems are discernible in the Himalaya. These are Alpine Arid Pastures and Alpine Moist Pastures.

The Western Ghats forms a nearly unbroken relief parallel to the Western Coast of Indian Peninsula for almost 1600 km with a latitudinal range of more than 10 degree. The range starts near the border of Gujarat and Maharashtra, south of the Tapti river, and runs through the states of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala, and ending at Kanyakumari at the southern tip of India. The Western Ghats also are among the 25 biodiversity hot spots globally identified. Wet evergreen, dry evergreen, moist deciduous and dry deciduous forests are clearly distinguished by the mean annual rainfall, whereas low, medium and high elevation wet evergreen types are distinguished by the decrease in minimum temperature with increasing altitude. In addition to forests, high altitude grasslands are another unique ecosystem in the Western Ghats.

The Eastern Ghats run from West Bengal state in the north, through Orissa and Andhra Pradesh to Tamil Nadu in the south passing some parts of Karnataka.

The Aravallis is a range of mountains in western India and eastern Pakistan running approximately 800 km from northeast to southwest across Indian states of Rajasthan, Haryana, and Gujarat and Pakistani provinces of Punjab and Sindh.

3.4 Species Diversity

India's large species diversity is what contributes to its recognition as one of the top 17 mega-diverse countries.⁴ The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as critically endangered, endangered and vulnerable). Critically endangered species are those that face an extremely high risk of extinction in the wild. As of 5 September 2011, there are 47 critically endangered species in India.⁵

3.5 Genetic Diversity

India is expected to have a very high genetic diversity in view of its varied climate, ecosystems, and high species diversity. However, almost all the available information on genetic diversity is confined to economically important agricultural crops and their wild relatives, as well as species of conservation priority. For example, a recent study by the Wildlife Institute of India indicated tiger population in the Ranthambore Tiger Reserve has shown a loss of genetic diversity over the years due to an isolated population without any genetic exchange. Urbanization and fragmentation in tiger corridors are the reasons for the isolated tiger population. A growing human population is leading to encroachment of large landscapes making the survival of many species difficult. The park's tiger population had reduced to 12 in 1992 and to 13 in 2003. It bounced back to 31 in 2010, but some conservation biologists feel lower genetic diversity may prove to be the ultimate threat to the population.

3.5.1 Domesticated (Agricultural) Biodiversity

Agricultural biodiversity is a sub-set of general biodiversity. It includes all forms of life directly relevant to agriculture: rare seed varieties and animal breeds (domesticated biodiversity), but also many other organisms such as soil fauna, weeds, pests, predators, and all of the native plants and animals (wild biodiversity) existing on and flowing through the farm. Agricultural biodiversity is the basis of our agricultural food chain, developed and safeguarded by farmers, livestock breeders, forest workers, fishermen and indigenous peoples throughout the world. Since most of India's landmass is under some kind of domestication with even "wilderness" areas having considerable interspersal of domesticated landscapes and species, it is critical that positive links between the wild and the domesticated be considered and encouraged.

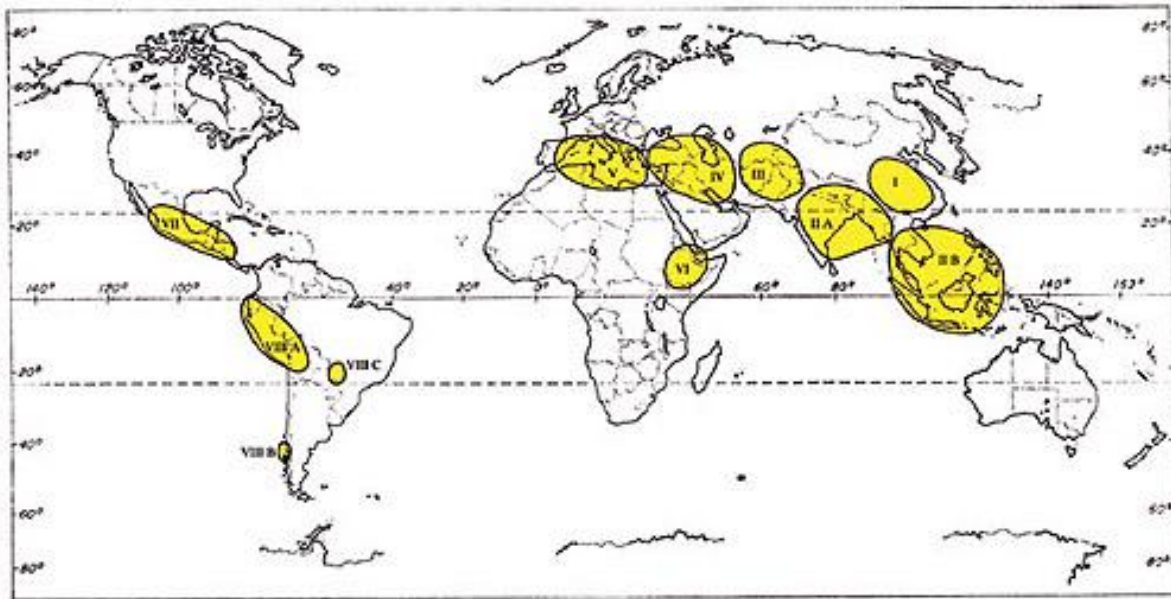
India is recognized as one of the eight Vavilovian Centers of Origin and Diversity of Crop Plants due to the high number of wild ancestors and close relatives of cultivated plants still growing and evolving under natural conditions. India's diversified farming systems hold thousands of locally-adapted crop varieties, including about 375 closely related wild species

Vavilovian centers of origin for crop plants: The Russian scientist, Nicolai Ivanovic Vavilov (1951), identified eight primary "Centers of Origin" of cultivated crop plants, considered the cradles of agriculture, based on the presence of greatest diversity which permitted agriculture to develop independently.

⁴ Please see Appendices for data tables of both the plant and animal species represented in India as compared to the world.

⁵ Please see Appendices for List of Critically Endangered Species of India.

mainly of rice, and several important pulses, millets, vegetables, fruits and fiber plants and nearly 140 native breeds of farm livestock (such as cattle, sheep, goat, camel, horse and poultry) (NBAP 2008).



Map of the eight Vavilovian centers of origin for crop plants

Knowledge of the origins of crop plants is vitally important in order to avoid genetic erosion, the loss of germplasm due to the loss of ecotypes, landrace associated with loss of habitat, and land conversion caused by increased urbanization. Wild species, related closely to their cultivated forms, are valued by plant breeders for obtaining genes for resistance to diseases and tolerance to stresses like drought, salinity and temperature. Continuing evolutionary development of these valuable species depends on adequate genetic diversity in their natural populations.

Efforts to conserve germplasm of plants and animals in gene banks are vital but an even more important task is to maintain biodiversity on farms (*in situ*) and in natural habitats (especially in centers of origin) where it can continue to evolve and adapt to changing conditions. As custodians of agricultural biodiversity, farmers are ideally suited to conserving and developing these genetic resources, ensuring their survival and availability to serve present and future needs. When farming communities abandon diversity and use modern intensive agriculture production methods, which demand many farmers to adopt high yielding varieties of plants and animals, plant varieties and breeds of animals can become extinct and their specialized locally adapted and useful traits may be lost. This is a concern because a narrow genetic base means more vulnerability to widespread epidemics and reduced resilience to changing climate conditions.

Conserving agricultural diversity forms an important defensive strategy for increased resilience against unforeseen effects of climate change and is one of the key components for developing plant varieties and animal species that may withstand significant temperature changes, extreme floods, droughts, and outbreak of diseases (Biodiversity Act).

As is with plant crops, nearly 140 native breeds of farm livestock and poultry are also facing similar threat to their survival. This is happening despite local breeds being genetically better adapted to their environment and more cost-effective as they are productive, despite consuming lower quality feed. The local breeds are also more resilient to climatic stress, are more resistant to local parasites and diseases, and serve as a unique reservoir of genes for improving health and performance of 'industrial' breeds. Conservation and greater use of local breeds are considered most effective in achieving national food and nutrition security objectives at the local level.

4. SOCIAL, ECONOMIC, AND POLITICAL CONTEXT OF CONSERVATION

4.1 Social and Economic Context

India is undergoing an unprecedented economic and social transition, when amplified by its population size, converges to create powerful implications for the future resource intensity of Indian society and resulting indirect impact on natural resources.

Economic and Social Transformation: As recently as 1985, more than 90 percent of Indians lived on less than a dollar a day. India's economic growth has accelerated since the 1990s, and so too has the spending power of its citizens. The resulting poverty alleviation and emergence of a middle class is reshaping the lifestyles of Indian families up and down the income pyramid. With one of the fastest growing economies in the world, India has become a large and globally important consumer economy. This remarkable economic and related social transformation has significant implications on resource pressure and environmental conservation.

Research from the McKinsey Global Institute estimates that within a generation, India will become a nation of upwardly mobile middle-class households, consuming goods ranging from high-end cars to designer clothing. In two decades India will surpass Germany as the world's fifth largest consumer market. As the unprecedented income growth transforms Indian society, the character of consumption is projected to change dramatically over the next 20 years. Households that can afford discretionary consumption will grow from 8 million today to 94 million by 2025.

Yet, despite India's success and growing middle class, poverty is still widespread in India, with the nation estimated to have 41.6% of its population is living below the international poverty line of \$1.25 (PPP) per day, and representing a third of the world's poor. As poverty entails not just income, but access to basic goods such as food, energy, and health care, the current gap in provisioning these basic life-sustaining services, nonetheless presents a significant resource challenge.

Population: India is the second most populous country in the world, with over 1.21 billion people (2011 census). Already containing 17.5% of the world's population, India is projected to be the world's most populous country by 2025, surpassing China. India has more than 50% of its population below the age of 25 and more than 65% hovers below the age of 35.

Convergence of Forces: The convergence of the demographic, economic, and social drivers of India's transition presents both positive and negative potential implications for environmental intensity. The interaction of these drivers is not linear and there are complex feedback loops among them, making strategic planning for sustainable development crucial over the next 5 years.

On the negative side, the significant increases in consumption needed for poverty alleviation combined with increases to overall consumption in moving toward a significant middle class and consumer culture, create a likely scenario of increased resource pressure unless a sustainable development path is pursued. For example, economic growth inherently requires large infrastructural and industrial projects, including highways, rural road networks, and energy development, putting enormous pressure on biodiversity and forests. With cities and townships expanding, often at the cost of agriculture, and agriculture expanding at the cost of tree cover, accelerating land conversion results in habitat and

biodiversity loss. In addition, changing lifestyles, with rising incomes and corresponding increases in consumption of resources, in both rural and urban areas, are placing increasing demands on resources. The combined population pressure and resource intensity inherently presents an indirect threat to biodiversity and forests in India.

However, on the positive side, there is a potential that steps taken to improve literacy, empower women, and invest in health and child welfare, may offset some of the anticipated environmental pressures. For example, India's economic growth and resulting poverty alleviation may reduce pressure on primary ecosystems for sustenance (fuel, fodder, protein sources, etc.), increased education which is correlated with reduced family size, and potential for a large, empowered middle class that demands environmental quality.

Although population growth and resource consumption are projected as indirect or root cause threats to biodiversity and forests, ultimately, India's ability to chart a path to sustainable economic development will determine the level where India's population, and the demands it places on natural resources, stabilizes.

4.2 Political Context

India plays an active role in international fora relating to conservation issues, including biodiversity, climate change and forests under various UN mechanisms, including the UNFCCC REDD plus negotiations. Interestingly, Indian is active at the interface of forests and biodiversity with active participation in the safeguard guidance and methodologies which environmental provisions, including biodiversity, of sustainable management of forests.

India, as a mega-diverse country rich in biodiversity and associated traditional knowledge, has significant political investment on the issue of access and benefit sharing and has been one of the lead negotiators on this theme under the Convention on Biological Diversity (CBD). India will host the 11th meeting of the Conference of the Parties (COP 11) to the CBD in October 2012. India, as the incoming Presidency of CBD at COP 11, has the opportunity to set the global agenda on biodiversity in the context of sustainable livelihoods for the period 2011-20. Considering that much more focus would now be on biodiversity in the UN Decade for Biodiversity (2011-20). Attempts are being made to significantly enhance funding for biodiversity programs through internal and external sources.

There are unique global implications for conservation and sustainable management of biodiversity and forests due to India's particularly active leadership role in international fora for biodiversity and environment. For example, India has ratified all of the major biodiversity and environment related global conventions, has played an important role in developing their agreed text, and continues to play a significant role in implementing guidelines for operationalization of the agreed principals. Given India's strong and growing leadership role internationally, particularly in representing developing countries on issues of global importance, complemented by the fact that India's growth trajectory is one that many countries aspire to, the opportunity is unprecedented for demonstrating a path and success in advancing conservation goals while continuing poverty alleviation and economic growth achievements, particularly despite population pressure and economic transition.

At the upcoming June 2012 United Nations Conference on Sustainable Development (UNCSD) “Rio +20”, India is expected to play an active role at the much anticipated convening of world leaders revisiting the sustainable development agenda. The two conference themes are 1) a green economy in the context of sustainable development and 2) the institutional frameworks needed for sustainable development.

4.3 Laws, Policies, and Institutions Affecting Conservation

In the Indian context, the economic, social, and political contexts are just as important as India’s biophysical endowments. India’s National Environment Policy (2006) underscores the guiding principal that “human beings are at the center of concerns of sustainable development and they are entitled to a healthy and productive life in harmony with nature” (NBAP). This concept of inclusive growth and environmental conservation in the context of poverty alleviation is an overarching theme in the Indian context and permeates most of the nation’s seminal policies regarding biodiversity, forestry, and climate change. In recognition that the consequences of loss of biodiversity and forest are often the harshest on the rural poor Indian policy, at least conceptually, recognizes the urgent need to recognize and factor-in the contributions made by ecosystem services to poverty alleviation efforts specifically, and to national economic growth more generally.

In addition to the National Environment Policy (2006), which seeks to mainstream environmental concerns in all development activities, a robust legal framework and body of laws exists pertaining to the three pillars of sustainable development. Conservation of biological diversity and forests as well as related environmental protection has been promoted through various policy measures including pollution control, water management, climate change, clean energy, and marine and coastal environment. However, despite this legislative effort, a number of challenges continue to exist. Although India possesses some of the finest legislative enactments in the South Asian region, a major weakness is enforcement of the law by responsible state agencies.⁶

4.3.1 Biodiversity

Pursuant to the CBD, India enacted the Biological Diversity Act (2002) and Biological Diversity Rules (2004) to regulate the use of biological resources and associated knowledge occurring in India for commercial or research purposes or for the purposes of bio-survey and bio-utilization. It provides a framework for access to biological resources and sharing the benefits arising out of such access and use. The Act also covers the transfer of research and application for intellectual property rights (IPRs) relating to biological resources. India is one of the few countries to have enacted such legislation.

The Act is being implemented at national, state and local levels, as a three-tier system. At the national level, the National Biodiversity Authority (NBA) was established in 2003 at Chennai, Tamil Nadu. The NBA is an autonomous, statutory and regulatory organization that is intended to implement the provisions of Biological Diversity Act. State Biodiversity Boards (SBB) have been established by the state governments and Biodiversity Management Committees (BMC) have been constituted by local bodies. Twenty four states out of twenty eight have so far set up State Biodiversity Boards. Eleven states, including Andhra Pradesh, Gujarat, Rajasthan, Karnataka, Madhya Pradesh, Manipur, Sikkim, West

⁶ See appendix for a list of the primary laws and policies relating to the conservation and management of biodiversity and forest resources in India.

Bengal, Tripura, Uttar Pradesh and Maharashtra have notified the state specific rules in accordance with the provisions of the Act. (NBA)

4.3.2 Forestry

The National Forest Policy (NFP) of 1988 is the seminal policy regarding forestry and marked a watershed in the way forests were perceived by the State Forest Departments. Recognizing the serious limitations of the exclusionary approach towards forest conservation that had been followed since India's independence, the NFP paved the way for bringing in more participatory means of conserving forests and biodiversity in which involvement of local people was a key ingredient. The need for meeting forest product requirements of rural people was, for the first time, given primacy over maximization of timber revenues, which had been the primary focus of governmental forest management since the British era. The NFP was the basis for many of the reforms that happened in the forestry sector in the last two decades.

The Forest (Conservation) Act of 1980 was enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. To this end the Act lays down the pre-requisites for the conversion of forest land for non-forest purposes

In 1990, the central government outlined and conveyed to state governments the Joint Forest Management (JFM) framework for creating a people's movement through involvement of village committees for the protection, regeneration and development of degraded forestlands. The National Afforestation and Eco-development Board (NAEB) set up in 1992 focuses on afforestation in forest and adjoining lands. The recent Forest Rights Act (2006) intended to regularize land claims of traditionally marginalized tribal communities, presents challenges and opportunities to address the complicated tenurial arrangements affecting forest management.

4.3.3 Institutional Challenges

Due to the fact that environmental management is generally a concurrent subject in the Indian constitution, whereby the central level sets broad policy guidance but implementation is a state matter, there is an inherent tension and challenge in the institutional arrangements for conservation. Given India's geographic size, the diversity of state-national interactions results in a wide variance in implementation, with less progressive states generally poorly responding to national mandates for conservation. For example, while Joint Forest Management Committees is an institutional arrangement recognized nationally, there are pockets of success as well as failures.

Given the broader challenges of sustainable development as indirect threats to biodiversity and forests and is beyond the jurisdiction of any one Ministry, India, like most countries, faces challenges in overcoming the ministerial siloes for activities and funding. Given the coordinating role that India's Planning Commission plays in budgetary and strategic planning, one promising opportunity for cross-ministerial approaches impacting environmental conservation is in the current formulation of the 12th five-year plan (2012-2017) which is looking explicitly at climate change implications of India's projected growth

in an effort to identify cost effective mitigation approaches as part of India's low carbon inclusive growth strategy.⁷

Watershed conservation provides a good illustration of the cross-sectoral nature of resource management and corresponding policy framework and inter-Ministerial interfacing that is needed. While several Ministries (Agriculture, Rural Development, and Water Resources) play a role in watershed management, the Forest Department, under the Ministry of Environment and Forests (MoEF), plays a crucial role in watershed protection and development. The Forest Department's role include protecting forests in upper catchment areas, and undertaking soil and water conservation and watershed development works on degraded forest lands as part of its regular ongoing forestry activities.

The National Forest Policy of 1988 stresses the need for the maintenance of environmental stability and for arresting soil erosion and denudation in the water catchment areas. Further, through the JFM guidelines of 1990, MoEF has strongly encouraged afforestation and forest protection in denuded areas through people's participation and microplanning, in a way that it not only meets the needs of the local communities but also fosters watershed and ecosystem stability at a larger scale. This is complemented by the National Water Policies of 1987 and of 2002 issued by the Ministry of Water Resources (MoWR) which also recognize the role of forests in providing watershed protection services. Both policies recognize that generation of water is one of the important services provided by watershed protection and development activities in upstream areas. While the 1987 Water Policy calls for the preservation and increase of forest cover to reduce the intensity of floods, the 2002 policy strongly encourages watershed management through extensive soil conservation, catchment area treatment, preservation of forests and increase in forest cover and calls for a participatory approach through greater community involvement in the management of water resources.

4.4 National Protected Area System

According to the IUCN definition of Protected Areas (PAs), a "protected area is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and cultural resources, and managed through legal or other effective means."⁸ In practice, protected areas are managed for a wide variety of purposes which may include: scientific research, wilderness protection, preservation of species and ecosystems, maintenance of environmental services, protection of specific natural and cultural features, tourism and recreation, education, sustainable use of resources from natural ecosystems, and the maintenance of cultural and traditional attributes.

Protected areas are the cornerstones of biodiversity conservation in India, and approximately 4.74% of the total geographical area of the country is under *in situ* conservation of habitats and ecosystems through a PA network (NBAP 2008).

⁷ See appendices for a table highlighting several of the institutions that affect conservation in India, starting with the traditional environment function but highlighting a few of the powerful and relevant Ministries with potential for cross-sectoral environmental impact.

⁸ IUCN(1994), Guidelines for protected area management categories. IUCN Commission on National Parks and Protected Areas, IUCN/ WCMC

Summary of India's Protected Area System	
Category of Protected Area	Number of each type of Protected Area
National Parks	96
Wildlife Sanctuary	509
Tiger Reserve	28
Elephant Reserve	25
Conservation Reserve and Community Reserve	3
Biosphere Reserve	17
World Heritage Site	5

Substantial biodiversity exists outside the precincts of formally declared protected areas, which are owned and managed by the local communities. Any future plans to expand the Protected Area network in India, would depend significantly in recognizing such Community Conserved Areas. Recent amendments to the Wildlife (Protection) Act provide for setting up of Community and Conservation Reserves.

4.4.1 Biosphere Reserves

To conserve the representative ecosystems, the Biosphere Reserve (BR) program is being implemented India. Fifteen BRs have been notified, of which seven have been recognized by the UNESCO under the World Network of BRs.

1. Nilgiri, 2000
2. Gulf of Mannar, 2001
3. Sunderbans, 2001
4. Nanda Devi, 2004
5. Nokrek, 2009
6. Pachmarhi, 2009
7. Simlipal, 2009

Fourteen more potential sites have also been identified for this purpose.

A BR is not intended to replace existing protected areas but it widens the scope of conventional approach of protection and further strengthens the Protected Area Network. Existing legally protected areas (national parks, wildlife sanctuary, tiger reserve and reserve/protected forests) may become part of a BR without any change in their legal status. However, the BR differ from protected areas due to their emphasis on:

- Conservation of overall biodiversity and landscape, rather than some specific flagship species, to allow natural and evolutionary processes to continue without any hindrance.
- Different components of BRs like landscapes, habitats, and species.
- Developmental activities, and resolution/mitigation of conflicts between development and conservation,

- Increase participation of stakeholders, especially local people's participation
- Environmentally-friendly development and sustained coordination amongst different development organizations and agencies.
- Research and monitoring to understand the structure and functioning of ecological system and their mode of reaction when exposed to human intervention. (BR Guidelines, 2007)

4.4.2 World Heritage Sites

Under the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), the following natural sites have been recognized in India:

- Kaziranga National Park (1985)
- Keoladeo National Park (1985)
- Manas Wildlife Sanctuary (1985)
- Nanda Devi and Valley of Flowers National Parks (1988)
- Sundarbans National Park (1987)

4.4.3 Marine Protected Areas

CBD defines a Marine Protected Area (MPA) as “any defined area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings”. As an area-based management tool, MPAs are considered useful in implementing both ‘ecosystem approach’ and ‘precautionary approach’, since their design involves managing pressures from human uses by adopting a degree of protection, which can range from strict protection, where all use activities are barred, to less stringent measures like sanctioning areas where multiple uses are allowed and regulated.

The first MPA in India was designated in 1967 for the protection of wetlands and of the birds migrating there, even before a specific legal framework for protected areas (PAs) was put in place. Currently, there are 31 MPAs along India's coastline (including the islands) that have been officially declared for conserving and protecting coastal and marine biodiversity. There are another 100 PAs that have terrestrial or freshwater components, which partly contain marine environment. Most of the MPAs were designated during the 1980s and early 1990s.

The primary legislation relevant for the designation of PAs, as national parks, wildlife sanctuaries, community reserves, conservation reserves and tiger reserves, is the Wildlife Protection Act 1972 (amended in 2002 and 2006). While the Act provides no specific definition for MPAs, they can be declared under any of the above five categories of PAs. Currently, existing MPAs are either declared as sanctuaries or national parks. The marine species protected under the Wildlife Protection Act include all five species of turtle found in Indian waters, ten species of shark and ray, all species of seahorse, giant grouper, reef-building corals, black coral, organ pipe coral, fire coral, sea fan, and nine species of mollusks and sea cucumber. All sponges and 15 species of mollusks are also prohibited from being hunted or captured.

The major Marine and Coastal Protected Areas (MCPAs) along the coastline of India (excluding the islands) that are important from a fishing-community and marine resource-conservation perspective are:

- Gulf of Mannar National Park
- Sundarbans National Park
- Gulf of Kachchh National Park
- Gulf of Kachchh Wildlife Sanctuary
- Malvan (Marine) Wildlife Sanctuary
- Gahirmatha (Marine) Wildlife Sanctuary

4.5 Participation in International Treaties/Agreements

India has participated in all major international events on environment issues, since the Stockholm Conference on Human Environment and Development in 1972. India is party to most multilateral environmental agreements⁹. It signed the United Nations Framework Convention on Climate Change (UNFCCC). It acceded to the Kyoto Protocol in August 2002. India became a signatory to the Convention on Biological Diversity (CBD) in December 1993 and ratified the convention in February 1994.

⁹ See appendices for a list of agreements ratified by India

5. THREATS AND UNIVERSE OF ACTIONS NEEDED TO CONSERVE BIODIVERSITY AND FORESTS

India's rich natural heritage of tropical forests and biological diversity, and the associated services provided by them, is under increasing pressure. Natural ecosystems and habitats are moving toward greater degradation while rare and endangered species are becoming more vulnerable. Over two-thirds of the country's total cultivable land is environmentally fragile and faces different degrees of degradation.

This section provides a summary of the threats and actions necessary to address them in order to improve the sustainable management of biological diversity and forests. The following lists the primary sources for the compilation of the key actions identified:

Millennium Development Goal - 2010 Status of Biodiversity:

The world has missed the 2010 target to slow the decline in biodiversity. Nearly 17,000 species of plants and animals are currently at risk of extinction, and the number of species threatened by extinction is growing by the day. Despite increased investment, *the main causes of biodiversity loss — high rates of consumption, habitat loss, invasive species, pollution and climate change* — are not being sufficiently addressed. Biodiversity is vitally important; billions of people rely directly on diverse species for their livelihoods and often survival.

Deforestation rates have slowed, but remain fastest in some of the world's most biologically diverse regions. Tree-planting programs, combined with the natural expansion of forests in some regions, have added more than 7 million hectares of new forest annually. As a result, the net loss of forest area over the period 2000-2010 was reduced to 5.2 million hectares per year, down from 8.3 million hectares per year in 1990-2000. South America and Africa continue to show the largest net losses of forests.

Source: Millennium Development Goals Fact Sheet Sept 2010

Biodiversity:

- **National Biodiversity Action Plan (NBAP), 2008:** India's most recent National Biodiversity Strategy Action Plan (2008) represents the government's official national strategy for conservation of biodiversity.
- **National Biodiversity Strategy and Action Plan (NBSAP), Citizen's Release, 2005:** Compared to the GOI-approved National Biodiversity Action Plan, the "citizen's release" of the stakeholder-led National Biodiversity Strategy and Action Plan shares several of the key thematic areas, but is much more extensive with detailed action items identified for implementation as well discusses the equity dimensions of conservation. A second striking difference, of relevance for the USAID/India strategy given that Food Security is one of the three focus sectors, is its significant focus and detailed discussion of domesticated biodiversity in agriculture systems.

Forestry:

- **The National Forest Commission Report (2006):** The Indian Prime Minister convened an unprecedented review of the working of the forestry and wildlife sectors under a National Forest

Commission. Its final report released in 2006 is an extremely comprehensive review and provides detailed recommendations to improve conservation including the legal framework, local community participation, personnel, industry, financial support, and center-state interactions.

- **The Energy and Resources Institute (TERI) Looking Back to Change Track (2006):** TERI as perhaps India's premier think tank regarding sustainable development, including biodiversity and forest conservation, produced a comprehensive retrospective analysis of conservation after India's Independence as well as a forward-looking appraisal of what is needed as of the 50 year anniversary of Independence in 2007. This includes explicit chapters on both forest resources and biological diversity.

The threats are broken down into Direct and Indirect threats, as defined in the box below:

Direct Threats are attributable to the immediate destruction of biological diversity (including tropical forests) are generally recognized as:

- **Conversion** of natural habitat to other forms of land use such as cropland, urban areas, or other human-dominated ecosystems; Agricultural expansion, urbanization and industrialization are the primary land uses replacing natural habitats.
- **Overexploitation** or overharvesting of valuable species and associated destructive harvesting practices; Over-exploitation of water for irrigation purposes.
- **Introduction of non-native species**, including invasive species and introduced pests and diseases.
- **Pollution** of land, water, or air; release of industrial effluents and dumping of solid wastes near waterways causing unintentional pressures; Urbanization and industrialization that has increased the loads of domestic waste, sewage, and industrial effluents dumped into rivers; agricultural expansion and excessive use of agrochemicals and fertilizer
- **Macro-environmental change**, such as climate change, desertification, or disruption of natural disturbance regimes (such as floods or fire)

Indirect Threats contribute to the direct threats and are also referred to as “**root causes**” or “**drivers**” of the direct threats and include:

- Demographic change, including rapid population growth, migration, and flows of refugees
- Rapid social and cultural change
- Poverty, lack of access to resources necessary for subsistence
- Economic policies and structures
- Global market forces
- Insecure land tenure and natural resource tenure
- Conflict, corruption and illegal harvesting of natural resources

Direct threat 1: Habitat Loss – fragmentation, degradation and loss, shrinking genetic diversity

Habitat destruction is identified as the main threat to biodiversity. Over a billion people, with their pressing needs for food, fiber, shelter, and fuel, combined with compelling need for economic development exert enormous pressure on natural resources. With half the total land under agriculture, and approximately 23 percent under forests, the protection of diverse habitats poses a formidable challenge. Forests face threats on account of conversion of forestland for agriculture, industry, human settlements, and other developmental projects. Construction of roads and canals, quarrying, shifting cultivation and encroachments are other threats.

Land conversion: The major impact of developmental activities involves conversion of forestland. Since the enactment of Forest (Conservation) Act in 1980, 1.14 million hectares of forest area, for about 14,997 development projects, has been approved for conversion.

Shrinking genetic diversity: Loss of habitats and over-exploitation have led to depletion of genetic diversity of several wild animals and cultivated plants. Shrinking genetic diversity leads to more vulnerability to diseases and pests and lesser adaptability to environmental changes. Conserving the flagship large animal species (such as the lion, tiger, rhino and elephant) has also highlighted the concern that these projects should aim at broadening the genetic base (gene pool) in breeding populations besides focusing on habitat protection. The decisive factor in saving critically endangered species is maintaining the minimum size and genetic base of inter-mating individuals rather than their total number, which may include the non-breeding individuals also.

India is remarkably rich in agriculturally important genetic resources. However, both the number of crops grown on commercial scale and the number of their varieties grown under different agro-ecosystems have severely declined in recent decades reducing thereby the agricultural biodiversity maintained in diverse farming systems. About 150 crops feed most of the human population at present, but just 12 of them provide 80% of food energy (with wheat, rice, maize and potato alone providing 60%). Also, about 30 mammalian and bird species are used extensively, but just 15 of them account for over 90 per cent of global livestock production. The Indian scenario is not very different. Choice of crops and farm livestock in agricultural production systems is now being largely influenced by market trends and changing lifestyles, affecting the variety, taste and nutrition value of our food basket. The Millennium Ecosystem Assessment points out that the significant increases in provisioning services achieved in recent times, and, in particular, food production through agriculture has been achieved at the expense of other ecosystem services, biodiversity and resilience of the resource base (MA 2005). The conversion of land to mono-cropped systems, with a high use of agrochemicals, high grazing pressure in drylands, and increased conversion of water for agriculture, have had the biggest impact on the balance of ecosystem services.

Action needed: Strengthening and integration of *in situ*, on-farm and *ex situ* conservation. This can be achieved by:

- Protecting and conserving through *in situ*, on-farm and *ex situ* conservation, major national bio-geographic zones, critical ecological systems and genetic resources, which are essential for life support, livelihoods, food and nutritional security; and are in consonance with the national economic growth and broad conception of human well-being.
- Identifying forest areas of incomparable social, ecological, or cultural values in order to arrest the conversion of forest land.

Direct threat 2: Over-exploitation of resources and declining forest resource base

Degradation of forests results from illicit felling, excess removal of forest products, fodder, fuel wood, forest floor litter, overgrazing, forest fires and illegal sand mining. Even though forestry is the second largest land use in India after agriculture, covering approximately 23.57 percent (recorded forest area) of the total geographical area, the contribution to the Gross Domestic Product from forestry is minimal (it was barely 1.1 percent in 2001). An estimated 41 percent of the country's forest cover has been degraded to some degree. As much as 78 percent of forest area is subject to heavy grazing and about 50 percent of the forest area is prone to forest fires. Domestic demand for timber and fuelwood is well above the sustainable level. Sand from river systems invariably fall under the jurisdiction of the forest department. India does not have any regulatory and monitoring framework to excavate sand (a minor forest produce) in a sustainable manner.

Actions needed: Augmentation of natural resource base and its sustainable utilization, ensuring inter and intra-generational equity. This can be achieved by:

- Promoting a holistic approach to conservation, enhancement and sustainable utilization of biodiversity, providing access to bioresources for all sections of society, in particular the economically poor, who are directly dependent on them, thereby ensuring inter- and intra-generational equity.
- Augmenting the supply of forest products by improving the productivity of existing forests and raising plantations outside traditional forest areas. As this would involve substantial financial resources, it is necessary to facilitate public-private partnership by instituting enabling legislation.
- Implementing demand side measures like improving efficiency in the usage of timber, fuelwood, and fodder along with finding alternatives to wood.
- Addressing issues of rights and tenure, as well as skills and capacity building of forest-dependent communities in order to realize the true potential of forests in providing livelihoods.

Direct threat 3: Invasive alien species

Among the major threats faced by native plant and animal species (and their habitats), the one posed by the invasive alien species¹⁰ is considered second only to habitat loss. Alien aquatic weeds like water hyacinth are increasingly choking waterways and degrading freshwater ecosystems. Lantana and carrot grass cause major economic losses in many parts of India. Highly invasive climbers like Chromolaena and Mikania species have over-run the native vegetation in North-East Himalayan region and Western Ghats. Numerous pests and pathogens such as coffee berry borer, turnip stripe virus, banana bunchy top virus, potato wart and golden nematode have invaded agro-ecosystems becoming serious menace.

Actions needed: Regulation of introduction of invasive alien species and their management. This can be achieved by:

- Developing unified national system for regulation of all introductions including their quarantine check, assessment and release.
- Improving management of invasive alien species and restore the adversely affected ecosystems.

Direct threat 4: Climate Change

¹⁰ The major plant invasive species include *Lantana camara*, *Eupatorium odoratum*, *E. adenophorum*, *Parthenium hysterophorus*, *Ageratum conyzoides*, *Mikania micrantha*, *Prosopis juliflora*, *Cytisus scoparius*, etc.

Climate change poses a significant threat to biodiversity, ecosystems, and the goods and services they provide. There are indications that the projected changes in temperature and CO₂ concentration may alter growth, reproduction and host-pathogen relationships in both plants and animals. According to the Millennium Ecosystem Assessment, climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century. Climate change is already forcing biodiversity to adapt either through shifting habitat, changing life cycles, or the development of new physical traits.

Climate change and habitat fragmentation: While the present global biota has been affected by fluctuating concentrations of atmospheric carbon dioxide, temperature, precipitation, and has coped through evolutionary changes over the last 1.8 million years, such climate changes, however, occurred over an extended period of time in a landscape that was not as fragmented as it is today and with little or no additional pressure from human activities. Habitat fragmentation has confined many species to relatively small areas within their previous ranges, resulting in reduced genetic variability. Warming beyond the ceiling of temperatures experienced to date will stress ecosystems and their biodiversity far beyond the levels imposed by the global climatic change that occurred in the recent evolutionary past. Current rates and magnitude of species extinction far exceed normal background rates. Human activities have already resulted in the loss of biodiversity and thus may have affected goods and services crucial for human well-being. The rate and magnitude of climate change induced by increased greenhouse gases emissions has and will continue to affect biodiversity either directly or in combination with other drivers of change. It is believed that the ecosystems with undiminished species diversity, and species with their genetic diversity intact, are likely to be in a much better position to face the impact of climate change.

Actions needed: Assessment of vulnerability, and adaptation to climate change and desertification. This can be achieved by:

- Developing appropriate tools, methodologies and indicators of impact of climate change, and desertification at the national level.
- Assessing vulnerability of various important national economic sectors to global threats such as climate change and desertification.
- Devising appropriate strategies for mitigating the impact of and adaptation to climate change, and desertification.
- Targeted research on impacts of climate change on forest types, eco-sensitive zones, crop yields and biodiversity is required under the changing climatic regime.
- Designing and implementing 'no-regret adaptation measures' in the forestry sector. These could include reducing forest fragmentation, maintaining proper health and hygiene of the forest ecosystems, developing efficient fire detection and management systems, promoting *ex situ* and *in situ* conservation of germplasm.

Direct threat 5: Impact of pollution

Biodiversity in India is facing threats from various sources of pollution, both point and non-point. The major threats to water bodies are from improper disposal of municipal solid waste, inadequate sewerage, excessive use of chemical pesticides and continuous use of hazardous chemicals even where non-hazardous alternatives are available. New industrial processes are generating a variety of toxic wastes, which cannot be dealt with by currently available technology in the country.

Although India's per hectare use of pesticide is very low as compared with many other countries, pesticide residues in land, water and food have been detected over the last three decades. Varying amounts of DDT and BHC residues have been found in agricultural produce including milk, meat and fodder. Levels found have been mostly below stipulated norms but their presence is a matter of concern.

Actions needed: Minimize Pollution impacts. This can be achieved by:

- Preventing, minimizing and abating impacts of pollution from point and non-point sources on various components of biological diversity, keeping in view cost minimization, polluter-pays principle, and imperatives of international trade and investment.

Direct threat 6: Gaps in Biodiversity information base

Understanding resources is a critical first step in their conservation. While an estimated 70% of the India's land area has been surveyed and around 45,500 species of plants and 91,000 species of animals have been described, it is estimated that about 400,000 more species may exist in India that need to be recorded and described. The baseline data on species and genetic diversity, and their macro-and micro-habitats, is inadequate. Further, although a number of organizations/agencies are working on various aspects of biodiversity, the information on the subject is scattered and not yet integrated into a national database. Some of the databases being developed are not up to the standard, primarily because of lack of infrastructure, skilled manpower and coordination among experts in different fields.

The information on biodiversity of freshwater, coastal and marine areas of the country is highly fragmented, although it has vast economic potential. Nearly 50% of the aquatic plants of the world are recorded from the Indian sub-continent but only a few have been studied in detail.

Actions needed: Development and integration of biodiversity databases. This can be achieved by:

- Collecting, collating and integrating biodiversity information from diverse sources into a national database on different components of biodiversity with distributed networking systems and linkages.
- Intensifying the survey, identification and inventorization of country's floristic, faunal and microbial resources with special attention to hitherto unexplored areas, and keystone, umbrella, endangered and endemic species which need to be conserved on priority basis.

Direct threat 7: Unknown impact of emerging biotechnologies

Significant investments in biotechnology research have been made in India and many research projects are at advanced stages of development. However, the biosafety concerns and long-term impact of introduction of transgenics or genetically modified organisms (GMOs) on biodiversity, particularly on genetic diversity of domesticated animals and crops, is far from clear. The sheer magnitude of potential benefits of transgenics, and the perceived fears of their possible harmful consequences, calls for urgent steps to review the existing mechanisms and protocols for biosafety assessment of transgenic organisms on a continuous basis.

Actions needed: Building of national capacities for biosafety and appropriate use of new technologies. This can be achieved by:

- Building institutional and human capacity for biosafety, *inter alia* for undertaking risk assessment and management of genetically modified organisms.

Indirect threat 1: Undervaluation of Ecosystem Services

The most significant anthropogenic threats to biodiversity are habitat loss due to forest conversion, degradation of habitat due to pollution or pesticides, grazing leading to reduction in plant biomass, fragmentation of habitat, logging, introduction of exotic species from other regions or continents, and climate change. The primary reason for the failure to conserve biodiversity is that its value is not well understood. For example, the decision to convert one hectare of forest rich in biodiversity for purposes such as agriculture or construction is usually based only on the immediate visible benefits with little attention paid to the many non-measurable ecological services provided by these ecosystems. Thus, if biodiversity is not measured, there is no way to arrive at rational decisions relating to competing land uses that may affect the preservation of species (GIST 2006).

Actions needed: Valuation of goods and services provided by biodiversity and use of economic instruments in decision making processes. This can be achieved by:

- Building capacities in valuation of ecosystem services.
- Assigning appropriate market value to the goods and services provided by various ecosystems and striving to incorporate these costs into decision-making, management and sustainable utilization of biological diversity resources.
- Factoring in natural resource accounting (NRA) in the national economic planning processes and encouraging financial institutions to adopt appropriate NRA appraisal practices so that risks to biological diversity are adequately considered in the financing of projects.
- Facilitating integration of biodiversity concerns into cost-benefit analysis with a view to encouraging more efficient allocation of resources while making public investment decisions.

Indirect threat 2: Fragmented Institutional framework: Enhancements needed to policy, legal and administrative measures

Although a number of policy, legal and administrative measures are in place to address various aspects of biodiversity and forest conservation, there is need to promote greater harmony and synergy in these measures. Another major identified gap is lack of effective enforcement of existing laws. The role of macro-economic policies and measures on land use, including biodiversity and forests, is least understood. Policies, which directly or indirectly work as incentives for habitat conversion are insensitive to biodiversity and forest concerns. There is a need for improving inter-sectoral coordination *inter alia* through continuous review and revision of mandates, and networking of institutions to ensure adequate coverage of biodiversity and forest concerns and issues and also to avoid duplication/overlapping of efforts.

Actions needed: Inter-sectoral coordination: strengthening implementation of policy, legislative and administrative measures for biodiversity conservation and management. This can be achieved by:

- Reviewing and updating the extant policy, legislative and administrative measures for conservation and management of biological diversity and forest management.

- Promoting greater harmony, synergy and linkages among extant policy, legal and administrative measures for conservation and management of biological diversity, forests, and associated traditional knowledge.
- Accelerating effective implementation of provisions of Biological Diversity Act and Rules with special attention to protecting the traditional knowledge (both codified and un-codified), innovations and practices, and encouraging their use, while ensuring equitable sharing of benefits arising out of their use as stipulated under the CBD.
- Accelerating effective implementation of Forest Rights Act (2006) and policy reform as needed (such as revision of the Indian Forest Act, 1927).

Indirect threat 3: Impact of development projects: Convergence of economic and social transformation amplified by population

India, with its large population, is poised for rapid economic growth. Large infrastructural and industrial projects, including highways, rural road network, and the special economic zones, are coming up. With cities and townships expanding, often at the cost of agriculture, and agriculture expanding at the cost of tree cover, fresh threats to biodiversity are emerging. In addition, changing lifestyles of the people, with rising incomes, in both rural and urban areas, are placing increasing demands on biodiversity and forests.

Population Pressure: India is the second most populous country in the world, with over 1.21 billion people (2011 census). Already containing 17.5% of the world's population, India is projected to be the world's most populous country by 2025, surpassing China.

Poverty and Resource Needs: Poverty is widespread in India, with the nation estimated to have a third of the world's poor. According to a 2005 World Bank estimate, 41.6% of the total Indian population falls below the international poverty line of US\$ 1.25 a day. Meeting the food, water, and energy needs of a large population presents significant challenges on the resource base.

Actions needed: Sustainable Development: Integration of biodiversity concerns in economic and social development. This can be achieved by:

- Integrating biodiversity and forest concerns into policies, plans, programs and projects for economic and social development.
- Achieving sustainable development based on protection, enhancement and management of natural resources.

6. SUMMARY OF GOVERNMENT, DONOR, AND NGO PROGRAMS AND ACTIVITIES

As a large country with numerous actors working to conserve biological diversity and forests at national, state and local levels, including government, donors, and non-governmental organizations, the following list only highlights the most salient efforts.

6.1 Government Programs and Activities

6.1.1 Biodiversity and Species Conservation

- The Centrally Sponsored Scheme 'Integrated Development of Wildlife Habitats' has been modified in 2008-09 by including a new component namely 'Recovery of Endangered Species' and 16 species¹¹ have been identified for recovery.
- Under the 'Recovery of Endangered Species' component of the Centrally Sponsored Scheme 'Integrated Development of Wildlife Habitats' \$770,816 for the recovery of endangered species viz. Hangul in Jammu and Kashmir, Snow Leopard in Jammu and Kashmir and Uttarakhand, Vulture in Punjab, Haryana and Gujarat was provided during 2008-09. During 2009-10, an amount of \$148,877.55 was provided for recovery of endangered species viz. Swiftlet in Andaman and Nicobar Islands, Nilgiri Tahr in Tamil Nadu, Sanghai Deer in Manipur and Snow Leopard in Arunachal Pradesh. During 2010-11, an amount of \$375,616.33 was provided for recovery of endangered species viz. Vulture in Punjab, Swiftlet in Andaman and Nicobar Islands, Snow Leopard in Himachal Pradesh and Jammu and Kashmir and Hangul in Jammu and Kashmir.
- Legal protection has been provided to endangered wild animals and plants against hunting and commercial exploitation under the provisions of the Wild Life (Protection) Act, 1972.
- The Wild Life (Protection) Act, 1972, has been amended and made more stringent. The punishments in cases of offences have been enhanced. The Act also provides for forfeiture of any equipment, vehicle or weapon that is used for committing wildlife offence.
- Protected areas, including national parks, sanctuaries, conservation reserves and community reserves all over the country covering the important habitats have been created as per the provisions of the Wild Life (Protection) Act, 1972 to provide better protection to wildlife, including threatened species and their habitat.
- Financial and technical assistance is extended to the state governments under various centrally sponsored schemes, such as, 'Integrated Development of Wildlife Habitats', 'Project Tiger' and 'Project Elephant' for providing better protection and conservation to wildlife.

¹¹ Snow Leopard, Bustard (including Floricans), Dolphin, Hangul, Nilgiri Tahr, Marine Turtles, Dugong, Edible Nest Swiftlet, Asian Wild Buffalo, Nicobar Megapode, Manipur Brow-antlered Deer, Vultures, Malabar Civet, Indian Rhinoceros, Asiatic Lion, Swamp Deer and Jerdon's Courser

- The Central Bureau of Investigation (CBI) has been empowered under the Wild Life (Protection) Act, 1972 to apprehend and prosecute wildlife offenders.
- The state governments have been requested to strengthen the field formations and intensify patrolling in and around the protected areas.
- The Wildlife Crime Control Bureau has been set up for control of poaching and illegal trade in wildlife and its products. Strict vigil is maintained through effective communication system.
- Based on the proposals received in the form of Annual Plan of Operations, Government of India provides financial and technical assistance to State/UT Governments for wildlife protection under the various Centrally Sponsored Schemes – Development of National Parks and Sanctuaries, Project Tiger and Project Elephant.

6.1.2.6 National Tiger Conservation Authority

Project Tiger Scheme has been under implementation since 1973 as a Centrally Sponsored Scheme of Government of India. The main objective of Project Tiger is to ensure a viable population of tiger in India for scientific, economic, aesthetic, cultural and ecological values and to preserve for all time, areas of biological importance as a natural heritage for the benefit, education and enjoyment of the people. Main objectives under the scheme include wildlife management, protection measures and site specific eco-development to reduce the dependency of local communities on tiger reserve resources.

The Wildlife (Protection) Act of 1972 was amended in 2006 to provide for constituting of the National Tiger Conservation Authority responsible for implementation of the Project Tiger plan to protect endangered tigers. The National Tiger Conservation Authority is set up under the Chairmanship of the Minister for Environment and Forests. The Authority will have experts or professionals having qualifications and experience in wildlife conservation and welfare of people including tribals, apart from three Members of Parliament. The Inspector General of Forests, in charge of project Tiger, will be ex-officio Member Secretary.

The National Tiger Conservation Authority would facilitate MoU with States within India's federal set up for tiger conservation. It will provide for an oversight by Parliament as well. Further, it will address livelihood interests of local people in areas surrounding Tiger Reserves, apart from ensuring that the rights of Scheduled Tribes and such other people living nearby are not interfered or adversely affected. The core (critical) and buffer (peripheral) areas have been defined, while safeguarding the interests of Scheduled Tribes and such other forest dwellers.

The functions and powers of the Authority, *inter alia* include: approval of Tiger Conservation Plan prepared by States, laying down normative standards for tiger conservation, providing information on several aspects which include protection, tiger estimation, patrolling, etc., ensuring measures for addressing man-wild animal conflicts and fostering co-existence with local people, preparing annual report for laying before Parliament, constitution of Steering Committee by States, preparation of tiger protection and conservation plans by States, ensuring agricultural, livelihood interests of people living in and around Tiger Reserves, establishing the tiger conservation foundation by States for supporting their development.

6.1.2.6 Project Elephant

Project Elephant (PE) was launched by the Government of India in the year 1992 as a Centrally Sponsored Scheme with objectives of protecting elephants, their habitat & corridors; addressing issues of man-animal conflict; and welfare of domesticated elephants

The Project is being mainly implemented in 13 States, viz. Andhra Pradesh, Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Nagaland, Orissa, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal. Small support is also being given to Maharashtra and Chattisgarh. Main activities under the Project are as follows:

- Ecological restoration of existing natural habitats and migratory routes of elephants;
- Development of scientific and planned management for conservation of elephant habitats and viable population of Wild Asiatic elephants in India;
- Promotion of measures for mitigation of man elephant conflict in crucial habitats and moderating pressures of human and domestic stock activities in crucial elephant habitats;
- Strengthening of measures for protection of Wild elephants from poachers and unnatural causes of death;
- Research on Elephant management related issues;
- Public education and awareness programs;
- Eco-development
- Veterinary care

6.1.2 Forestry

6.1.2.1 National Mission for a Green India (GIM)

While there have been multiple activities and programs to conserve forests over the years, the current efforts are focused on the 2010 announcement of the National Mission for a Green India (GIM). It has the overarching aim of responding to climate change by a combination of adaptation and mitigation measures, which would help:

- Enhance carbon sinks in sustainably managed forests and other ecosystems;
- Adaptation of vulnerable species/ecosystems to the changing climate; and
- Adaptation of forest-dependent communities

The GIM's tactical objectives include:

- Increased forest/tree cover on 5 million ha of forest/non-forest lands and improved quality of forest cover on another 5 million ha (a total of 10 million ha)
- Improved ecosystem services including biodiversity, hydrological services and carbon sequestration as a result of treatment of 10 million ha.
- Increased forest-based livelihood income for 3 million forest dependent households
- Enhanced annual CO₂ sequestration of 50-60 million tonnes by the year 2020

Key innovations under the GIM approach include:

- Focus on quality of forests: primary focus on improving density of forest cover.
- Focus on ecosystem services: emphasis on biodiversity, water and improved biomass; carbon sequestration as co-benefit; addressing ecosystems like grasslands, wetlands, urban and peri-urban.
- Focus on democratic decentralization: gram sabha as overarching institution to facilitate implementation of the Mission activities at village level.
- Creating a new cadre of community youth as foresters: build a skilled cadre of young “community foresters” from scheduled tribes and other forest dwelling communities.
- Adoption of landscape-based approach: Interventions at scale (5000-6000 hectares) at a time; simultaneous treatment of forest and non forest areas; addressing key drivers of degradation.

Cross-cutting components include:

- Improved fuel use: efficiency and alternative energy devices for 3 million households.
- Livelihood enhancement: provision of \$30-40 thousand for each village (30,000 villages).
- Corridors: Identification and working with an array of stakeholders to maintain cover; rapid agency response in case of crop raiding.
- Support to community conserved areas (about 14,000 sacred groves).
- Identifying and protecting areas /catchments of hydrological significance

6.1.2.4 Joint Forest Management (JFM)

Joint Forest Management (JFM), which began in India in the 1980s and was institutionalized in 1990s, is the pre-dominant mechanism for involving local communities in the management and protection of forests. JFM is an incentive based model wherein the local communities are given a share of the revenue from forests (both timber and non-timber components), without conferring ownership rights, in lieu of their efforts in protecting and managing state-owned forests. The participation of the JFMCs is enabled through a Memorandum of Understanding (MOU) with the State Forest Department (SFD). There are about 100,000 Joint Forest Management Committees (JFMCs) in the country that manage over 20 million hectares out of the 76 million hectares of forest lands. The Green India mission now mandates all JFM committees to be sub-committees of the Gram Sabha.

JFMCs have two types of accounts that receive funds from state governments. The development account receives funds for implementing various government schemes and projects, while the committee account receives the amount earned by JFMC's for their role in forest protection (labor component and revenues from sale of timber as well as non-timber forest produces). In turn, the funds from the committee accounts are used for both forest development and community development activities.

6.1.2.3 National Afforestation Program (NAP)

The National Afforestation Programme (NAP) was formulated by merger of four 9th Plan centrally sponsored afforestation schemes of the Ministry of Environment & Forests, namely, Integrated Afforestation and Eco-Development Projects Scheme (IAEPS), Area Oriented Fuel wood and Fodder Projects Scheme (AOFFPS), Conservation and Development of Non-Timber Forest Produce including Medicinal Plants Scheme (NTFP) and Association of Scheduled Tribes and Rural Poor in Regeneration of Degraded Forests (ASTRP), with a view to reducing multiplicity of schemes with similar objectives, ensuring uniformity in funding pattern and implementation mechanism, avoiding delays in availability of

funds to the field level and institutionalizing peoples' participation in project formulation and its implementation. The Scheme will be operated by the National Afforestation and Eco-Development Board, Ministry of Environment and Forests as a 100% Central Sector/ Centrally Sponsored Scheme (except for the AOFFP component).

The NAP is being implemented through a 2-tier structure of Forest Development Agency (FDA) at the forest division level and Joint Forest Management Committee (JFMC) at the village level. Thus, FDA is the confederation of JFMCs in that forest division. FDAs are registered under the Societies Registration Act. JFMCs are registered either with the Forest Department or under statutory provisions. The district-level officers of relevant line departments of the State Government and Panchayati Raj Institution are members of FDA. The institutions of FDAs and JFMCs are highly innovative resource transfer mechanisms whereby the Government of India channelises funds directly to the grass root level implementing agency for the afforestation activities.

6.1.2.4 Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

The Forest Rights Act, 2006, recognizes three types of rights:

Land Rights

No one gets rights to any land that they have not been cultivating prior to December 13, 2005 and that they are not cultivating right now. Those who are cultivating land but don't have document can claim up to four hectares, as long as they are cultivating the land themselves for a livelihood. Those who have a patta or a government lease, but whose land has been illegally taken by the Forest Department or whose land is the subject of a dispute between Forest and Revenue Departments, can claim those lands. The land cannot be sold or transferred to anyone except by inheritance.

Use Rights

The law secondly provides for rights to use and/or collect the following:

- a) Non timber forest produce (like tendu patta, herbs, medicinal plants) that has been traditionally collected.
- b) Grazing grounds and water bodies
- c) Traditional areas of use by nomadic or pastoralist communities, i.e. communities that move with their herds, as opposed to practicing settled agriculture.

Right to protect and conserve

For the first time, this law also gives the community the right to protect and manage the forest. It provides a right and a power to conserve community forest resources, while also giving the community a general power to protect wildlife, forests, etc.

As per the information collected till 29th February, 2012, more than 3.17 million claims have been filed and more than 1.25 million titles have been distributed.

6.1.2.5 Compensatory Afforestation Fund Management and Planning Authority (CAMPA)

The CAMPA fund was established as a means to compensate the forestry land for mining or other development activities that cause deforestation. The purpose of the fund is for afforestation but not necessarily in the same area as the development activity. In other words, it is a type of forestry offset fund.

CAMPA funds are intended for undertaking compensatory afforestation, assisted natural regeneration, conservation and protection of forests, infrastructure development, wildlife conservation and protection and other related activities. The Guidelines on State Compensatory Afforestation Fund Management and Planning Authority (State CAMPA) indicate that CAMPA would provide an integrated framework for utilizing multiple sources of funding and activities relating to protection and management of forests and wildlife. Its prime task would be regenerating natural forests and building up the institution engaged in this work in the State Forest Department including training of the forest officials of various levels with an emphasis on training of the staff at cutting edge level (forest range level) [emphasis added]. The amount received by it will also be utilized for providing residential accommodation to the field staff and necessary machines and equipment to them. In short, the department would be modernized to protect and regenerate the forests and wildlife habitat.

6.1.2.6 Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is managed by the Ministry of Rural Development as an Indian job guarantee program enacted by legislation in 2005.

The program provides a legal guarantee for one hundred days of employment per year to adult members of any rural household willing to do public works-related unskilled manual labor at the statutory minimum wage of Rs.100 per day. Around one-third of the stipulated work force is women.

The MGNREGA achieves twin objectives of rural development and employment. MGNREGA stipulates that works must be targeted towards a set of specific rural development activities such as: water conservation and harvesting, afforestation, rural connectivity, flood control and protection such as construction and repair of embankments, etc. Digging of new tanks/ponds, percolation tanks and construction of small check dams are also given importance. The employed are given work such as land leveling and tree planting. The MoEF already uses this program heavily to achieve current afforestation targets. The Ministry of Rural Development also uses the program for their watershed management and restoration of degraded lands activities.

As background, the MGNREGA builds on the historical activities starting with the National Rural Employment Program (NREP) which was launched in October, 1980 and became a regular Plan program from April, 1981.

6.1.3 Water

Maintaining healthy forest ecosystems is essential to ensure water availability and other ecosystem services derived from the forests. The water management functions of the ecosystems are crucial for a stable food supply including provisioning services such as biomass and crop production, as well as for fisheries and aquaculture.

The Ganges River is both one of the most venerated and polluted rivers in the world. The National River flows in eight states, watering 47% of the total irrigated area in one of the most densely populated areas of India and the world. Pollution load on rivers has increased over the years due to rapid urbanization and industrialization. Abstraction of water for irrigation, drinking, industrial use, and power compounds the challenge. Discharge of untreated wastewater (sewage and industrial) from towns along the rivers constitutes the major source of pollution load in rivers.

The Ganga Action Plan (GAP) was a program launched by Rajiv Gandhi in April 1985 in order to reduce the pollution load on the Ganges River including the tributaries of the Ganges: Yamuna, Gomti, Damodar and Mahananda. The objective was to intercept, divert and treat a million liters of sewage. The program was launched with much fanfare, but it failed to decrease the pollution level in the river, after spending \$183.88 million over a period of 15 years. The GAP has been recently reinvigorated, with the Central Government approval of a project in April 2011, under the National Ganga River Basin Authority for abatement of pollution of river Ganga with World Bank providing financial assistance of \$1 billion. The principal objective of the project is to fund creation of pollution abatement infrastructure for conservation and restoration of water quality of the river.

6.2 Donor Supported Programs and Activities

Food and Agriculture Organization (FAO)

FAO has two major engagements with GoI on forestry: 1) creation of a forest policy center; and 2) Non-timber forest products (NTFPs) inventory. They are working with the government to create an independent national center for forest policy and research that would be based in Dehradun. Some priorities of the center would be to integrate forestry policy across multiple sectors and to engage with civil society. For the NTFP inventory, FAO is working to strengthen the inventory in terms of scientific information and harvesting practices of NTFPs.

European Commission (EC)

The EU funded a project called the "Haryana Community Forestry Project" from 1999 to 2008 in Haryana state. Part of this project became the first small-scale afforestation project in the world to be certified by the Clean Development Mechanism (CDM). The project also included training village management committees in natural resources management and increasing women's and minorities leadership and participation.

United National Development Program (UNDP)

UNDP is working with five states on Climate Change Action Plan support. They plan to support India in implementing the Green India Mission. UNDP coordinates the Climate Change Cluster. This group meets regularly to discuss climate change related activities in India.

World Bank (WB)

WB has worked for three decades with MoEF on forestry, but they currently have no active programs.

Swiss Agency for Development and Cooperation (SDC)

SDC has been involved in NRM activities in India since the 1970s. They have worked with Joint Forest Management (JFM, see “Community Forestry” Section 6) in Rajasthan and Maharashtra and have plans to develop adaptation and REDD+ activities in the Himalayas.

UK Department for International Development (DFID)

DFID had a large forestry program working with state governments in three states on forest sector governance, sustainable forest management, and livelihood enhancement. These projects finished in 2005. They currently have rural livelihood programs in Bihar, Madhya Pradesh, and Orissa that have a forestry component, and have just recently exited from livelihood projects in West Bengal and Andhra Pradesh. Half of their portfolio is focused on national level programs. This is critical, they say, since most policies are pushed from the center, including forestry.

Japan International Cooperation Agency (JICA)

JICA, as the largest bilateral donor in India, has multiple large projects with explicit or potential linkages with conservation of biological diversity and forests as well as broader natural resource management such as integrated water resource management, tourism, water supply, sanitation, and sewerage, low carbon technologies, and transport and energy sector investments.

JICA has forestry programs in eleven states—Uttar Pradesh, Haryana, Punjab, Tamil Nadu, Karnataka, Sikkim, Himachal Pradesh, Tripura, Rajasthan, Orissa, and Gujarat. They are starting to work in West Bengal. Working in coordination with state governments, most projects have an afforestation and livelihood focus and are working with Joint Forest Management Committees. In addition to the state projects, JICA is working with MoEF on capacity building of forest guards and forest officers in all states. They are also supporting infrastructure improvement at state forestry offices.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

GIZ is working with MoEF on a climate change adaptation program in rural areas of four states—Rajasthan, Madhya Pradesh, West Bengal, and Tamil Nadu. They are doing vulnerability assessments at the district level and looking at technical adaptation solutions, including forestry related components. GIZ is also getting started on projects on biodiversity conservation and payment for ecosystem services.

Agence Française de Développement (AFD)

AFD is supporting the state of Assam in North East India, which is promoting a sustainable management of its forest combining sound exploitation and preservation. AFD has approved a €54m loan to the Indian Government for this purpose. The loan is financing activities to reforest damaged forest areas, define participative forest management plans involving local communities more and train State administrative staff to raise their awareness of the importance of preserving the natural capital. The ultimate aim of this project is to restore forest ecosystems in partnership with communities who rely on them for their livelihood. This will improve the standard of living of these communities and contribute to the sustainable preservation and use of forest resources. An international technical assistance, funded through AFD's own resources, is provided in order to support the project launch.

Global Environment Facility (GEF) /United Nations Environment Programme (UNEP) support for Access and Benefit Sharing (ABS): The Ministry of Environment and Forests (MoEF) and National Biodiversity Authority (NBA) are working with GEF/UNEP on strengthening the implementation of the Biological Diversity Act and Rules with a focus on its Access and Benefit Sharing (ABS) Provisions, including assessing the economic value of genetic resources and sharing the benefits arising out of them among local people. This project is being implemented in 5 states of India -- Andhra Pradesh, Gujarat, West Bengal, Himachal Pradesh and Sikkim. The main components of the project include:

- Identification of biodiversity with potential for ABS and their valuation in selected ecosystems such as forest, agriculture and wetlands.
- Development of tools, methodologies, guidelines, frameworks for implementing ABS provisions of the Biological Diversity Act.
- Piloting agreements on ABS.
- Implementation of policy and regulatory frameworks relating to ABS provisions at the national level and thereby contribute to international ABS policy issues.
- Capacity building for strengthening implementation of the ABS provisions of the Biodiversity Act.
- Increase public awareness and education programs.

Norwegian support for Centre for Biodiversity and Law (CEBPOL): The Ministry of Environment and Forests has decided to establish a Centre for Biodiversity Policy and Law (CEBPOL) in the National Biodiversity Authority (NBA), Chennai, which is a statutory autonomous body of the Ministry responsible for implementing the Biological Diversity Act. The Government of Norway has offered to provide technical and institutional collaboration for the CEBPOL. Norway is the first developed country to have recently enacted a national legislation on ABS. India and Norway can thus learn from each other's experiences relating to ABS and traditional knowledge. The objectives of CEBPOL are to develop professional expertise in the complex and still-evolving policy and legal issues relating to biodiversity, including on access and benefit sharing, through research, development and training and to provide advice and expertise to GOI on these matters. The Centre is also expected to contribute to strengthening the implementation of the Biological Diversity Act. The setting up of this Centre is a timely initiative taken by GOI, considering that the 2010 Conference of the Parties to the Convention on Biological Diversity in Nagoya, Japan adopted the Nagoya Protocol on Access and Benefit Sharing.

6.3 Non-Governmental Organizations (NGO) Program and Activities

India has a long tradition of social service, social reform and voluntary work. Over the years a large number of NGOs have emerged in India to work on issues related to socio-economic problems, livelihood and social discrimination. These groups work on behalf of the poor, the landless, the tribals, the laborers and other social groups who face marginalization and discrimination under the existing social structure. Many are grassroots organizations that work at the micro-level with limited resources but often achieve significant results at the village or watershed level. Still others have a more scientific focus with greater attention to environmental research that can inform national and local policy-making on environment.

In the forestry sector a number of non-government organizations of all sizes and capabilities have been actively working for the past many decades particularly in the field of extension, implementation, policy advocacy and environmental public interest litigation. Many of the achievements of the past two decades in the field of biodiversity conservation, wildlife management, social forestry and sustainable development can be attributed to the active role that the NGOs have played. These NGOs have also been able to use the country's judiciary to bear on the executive to enhance the quality of delivery in these areas. The NGOs have also played an important facilitation role that includes research, training, policy analysis, documentation and the organization of seminars and workshops.

NGOs have a major role to play in educating the public and creating a broad public demand for government-wide responsiveness towards environmental conservation. Forestry and watershed management have attracted the maximum attention and interest of voluntary agencies to build environmentally sound principles, processes, procedures and practices related with forests and environment while keeping a special focus on social and economic equity. In situations of partnerships between forest managers and NGOs, there are significant gains in the area of forest conservation. In the Eighth Five Year Plan, the importance of NGOs was enhanced due to their participation in rural appraisal for drawing up development plans at a very low cost and involving the rural community. Today, India has a vigorous NGO sector. Though there has been no complete census of NGOs, it is estimated that about 25,000 to 30,000 of different sizes are active in India.

Yet there are a number of constraints that limit the effectiveness of NGOs in India such as reduced access to technical expertise and knowledge, limited area of reach and small scale of funding. The experiences in India indicate that the NGO community has a very important role to play in capacity building, education, awareness raising and training community representatives to take up the leadership role in forest restoration initiatives under the JFM program. (Source: IUFRO, 2008)

In the wildlife sector, there are various NGOs working at various levels (national, state and local) and on multiple activities (Wildlife Research; Capacity Building; Policy Interventions and Site-based conservation). The Worldwide Fund for Nature (WWF)-India, the Wildlife Conservation Society (WCS) and the Wildlife Protection Society of India (WPSI), and the Wildlife Conservation trust (WCT) are among the well-known NGOs working on multiple activities across the country.

On the research front, Ashoka Trust for Research in Ecology and the Environment (ATREE) works towards advancing protection of the environment and conservation of biodiversity. Nature Conservation Foundation (NCF) is devoted to research and action for conservation of wildlife and natural ecosystems.

An example of capacity building is the work of WPSI that collaborates with state governments to monitor the illegal wildlife trade and provide them with hands-on training and support to combat poaching and the illegal wildlife trade.

Some of the organizations work at local level, e.g., Kuduremukh Wildlife Foundation focuses its work on conserving the unique Kuduremukh National Park while another conservation NGO, the Bhadra Wildlife Conservation Trust, is dedicated to saving the Bhadra Tiger Reserve.

7. LINKAGES OF USAID/INDIA DEVELOPMENT OBJECTIVES WITH FORESTRY AND BIODIVERSITY CONSERVATION

7.1 Identification of Opportunities for Conservation Linkages

This report puts significant emphasis on identification of conservation opportunities of the Mission's portfolio. This chapter is considered valuable to the Mission for the purposes of informing decision-making and the final Country Development Cooperation Strategy (CDCS). While the background analysis is critical to understand the overall conservation needs in India, it is the Mission's consideration of how addressing conservation needs is potentially aligned with the strategic vision of its portfolio and within its manageable interest. This chapter looks broadly for opportunities to efficiently include conservation where most relevant to the Mission's portfolio based on its stated strategy.

The biological diversity and forest conservation needs in India was analyzed to identify opportunities to integrate conservation of biological diversity and forests across the portfolio under its proposed CDCS for 2013-2017. Each of the three development objectives - Climate Change, Food Security and Health are analyzed for opportunities for conservation relevance, including mapping linkages between sectors in order to identify areas of integrated or cross-cutting approaches. For each of the components of the strategy, the analysis considers the potential linkages with conservation of biodiversity and tropical forests.

7.2 Conservation Linkages

7.2.1 Climate Change

Ecosystems are not only affected by climate change but also affect the climate – conserved or restored habitats can remove carbon dioxide from the atmosphere, thus helping to address climate change by storing carbon (for example, reducing emissions from deforestation and forest degradation). Similarly, just as climate change may be characterized as an additional stressor on biological systems, the carbon mitigation value of natural systems is a service provided by ecosystems. Conserving natural terrestrial, freshwater and marine ecosystems and restoring degraded ecosystems is essential for the overall goals of both the CBD and UNFCCC because of the role ecosystems play in the global carbon cycle and in adapting to climate change. This is in addition to providing a wide range of climate-sensitive ecosystem services that are essential for human well-being and the achievement of the Millennium Development Goals (MDG) for ensuring environmental sustainability. In the proposed strategy, the Climate Change DO is limited to the mitigation dimension of climate change.

7.2.1.1 Low Emissions Development Strategies (LEDS)

Two critical challenges for conservation of biological diversity and forests are the valuation of the contribution of natural resources in macro-economic planning to sustainable development and the corresponding related institutional framework for strategic planning across sectors and ministries. Low carbon planning and implementation is at the heart of these two issues and presents an opportunity for this needed cross-sectoral planning, consideration of tradeoffs in different land use and industrial sector scenarios, as well as consideration of environmental costs and benefits. To the extent that national planning exercises are starting to consider carbon as related to specific sectors, it is not a stretch to

expand the scope to consider the additional ecosystem services provided by forests and biodiversity and their relative importance to macroeconomic “green” planning.

The DO’s support for broad, whole-of-economy emissions reductions strategies (under the LEDS activities) has the objective of supporting the Planning Commission in partnership with the nodal ministries for discrete sectors, including forestry as a targeted area of implementation under the umbrella low-carbon strategy. The LEDS support could include an explicit consideration of the forestry, land use, biodiversity and water resource tradeoffs in economic growth planning and provide strategic inputs to support the methodologies, analysis, quantification, and management of natural resource conservation within a low carbon inclusive growth strategy.

7.2.1.2 Clean Energy

Energy demands and extraction of fuel sources put enormous direct pressure on biodiversity and forestry resources through habitat destruction when large-scale land conversion is undertaken for coal mining and flooding in hydroelectric projects. In rural areas, collection of biomass fuels for cooking and heating are a direct but more diffuse threat to forests and biodiversity. As reflected in the MDG goal for environmental sustainability, greenhouse gas emissions (power generation is a major source) indirectly disturb ecosystem functioning by changing the climatic and hydrological regimes. Any improvements in energy efficiency may indirectly reduce these pressures on biological resources. In addition, savings of public resources from subsidies for inefficient energy management could free up revenues that could be used for other public purposes such as conservation. Watershed management is also important for the energy sector. Hydropower is a significant source of electricity in India, providing an estimated 21%. India is endowed with immense hydroelectric potential and ranks 5th globally in terms of exploitable hydro-potential. Hydropower is particularly dependent on upstream ecosystem and watershed services. Depletion of the vegetative cover in the watershed areas results in sedimentation of reservoirs, substantially reducing their capacity to store water for hydropower and irrigation.

7.2.1.3 Forestry and Land Use Sector (Sustainable Landscapes)

Forests and biodiversity both play key roles maintaining stable climates. Forests may be seen as a direct carbon sink (or source when under conditions of deforestation). Biodiversity may be characterized as a critical ingredient to maintain healthy forests that have adaptive capacity necessary to enable their functioning as a sink. GOI’s Green India Mission underscores its strategic approach to support multiple ecosystem services or benefits derived from sustainable management of forests, with carbon recognized as only one benefit amongst the multiple benefits that include hydrological and biodiversity services. For example, forests offer more than just timber for harvest and their role in storing carbon; they also protect biodiversity, reduce erosion, improve the quantity and quality of water, and provide an array of non-timber forest products.

The DO closely aligns with the conservation linkages identified between conservation of biological diversity and forests under the sustainable landscapes (Forest-PLUS) program. An ecosystem approach is consistent with USAID Climate Change & Development Strategy (2012) guiding principle of Valuing ecosystem services: Well-managed ecosystems provide myriad services such as food, water supply and filtration, carbon storage, erosion control, flood protection and biological diversity. Although these services are critical to development, they are often not valued appropriately in the marketplace.

7.2.1.4 Climate Change Adaptation - Forestry and Land use Sector

Forests and biodiversity play key roles in climate resilience and adaptive capacity. Given the unknown changes in micro or regionalized climate regimes and resulting changes to hydrological patterns, species variation and assemblages, and disease patterns, consideration of the adaptive capacity of forests is suggested in order to make prudent long-term investments in the forestry sector. For example, streamlining climate change adaptation in forestry activities could include consideration of appropriate species selection for assisted regeneration and location choices relative to ground water sources in a changed climate scenario.

7.2.2 Food Security

In India, with nearly 250 million people living within a distance of 50 km from the coasts, coastal and marine environments provide important ecosystem services as well as food security benefits to a significant population. An estimated 97.8% of fish production is consumed in coastal states, which support 50% of the total Indian population. Population growth, urbanization and shifting consumption patterns threaten the capacity of ecosystems to support food production and other services.

Recent research suggests that declines in ecosystem services—leading to problems such as soil nutrient depletion, loss of biodiversity, soil erosion, increased vulnerability to disease and pests, and loss of buffering and storage capacity to deal with rainfall variability—have already begun to adversely affect agricultural productivity and will continue to do so at an accelerating rate under anticipated climate change. As a result, crop yields could fall 5-25% short of demand by 2050. These problems have the greatest impact on the poorest people—those who are directly dependent on natural resources for food and livelihoods. To meet the challenge of increasing food production to feed the additional 2 billion people expected to swell the world's population in the next several decades will require a focus on managing crop production to managing agro-ecosystems for multiple services. The approach suggests taking a broader view of food production systems and appreciating the connections between ecosystems, water and food, to identify opportunities to increase not just “crop per drop” but also food and other ecosystem services per drop.

In an agro-ecosystem approach, there is a shift in focus from “food production systems” to agro-ecosystems that provide a wider variety of services; agriculture is viewed part of its own ecosystem that has certain ecosystem needs, functions and services and that interacts with other ecosystems. This requires managing agricultural lands as part of a larger ecosystem within a landscape mosaic and addressing bundles of interlinked services, including those that support food production. Taking an agro-ecosystem approach at the landscape level also makes it easier to identify and act on opportunities for synergies among crops, fish, livestock, tree and forest products. For example, the reuse of agricultural waste products, such as crop residue and by-products from processing, in animal feed, can increase the amount of food produced without increasing the amount of land and water resources required. Strategic placement of trees in agro-ecological landscapes can increase water infiltration and percolation, thereby improving overall water productivity while providing fuel, fodder, fruit and timber. This approach would require collaboration between the Ministries of Environment and Forests and Agriculture in: (a) increasing awareness of the role ecosystem services play in water and food security, and of opportunities for enhancing a range of ecosystem services in agro-ecosystems; (b) promoting more considered evaluation of potential trade-offs associated with food security policy and planning; and (c) encouraging better cooperation with other sectors to improve sustainability and productivity of food supply systems.

The Food Security DO's strategic focus on the human and academic understanding of food security and its related components, including natural resource management, is very timely and addresses an area of need identified in the conservation needs assessment. Of particular relevance to conservation of biological diversity and forest resources would be advancement of the science and application around the integrated agro-ecosystems, use of agroforestry systems, the carbon-water-nutrient cycling, and incorporation of climate variability in crop and farm planning and management.

7.2.2.1 Agricultural Biodiversity and Natural Resource Management

Agriculture biodiversity is a fundamental and necessary part of sustainable agricultural systems and India is recognized as a globally significant repository of wild varieties. A robust approach to natural resource management should explicitly seek to conserve agricultural biodiversity as well as consider climate adaptation. For example, given changing climates, agricultural system resilience and their ability to adapt may very well rely on the species uniquely evolved to specific microclimates. Also there is potential loss of distribution in the pattern of agricultural biodiversity, including important pollinators, pests, and predators.

This natural resource management could be expanded or more explicitly include conservation of agricultural biodiversity such as review of environmental threats and good practices for key biological species critical to food security such as pollination, pests, predators, etc. as well as support cultivation and maintenance of germplasm of wild relatives of agriculturally important crops and livestock.

7.2.2.2 Livestock Management

Livestock represent an important component of food security (dairy in the case of India) with women generally tending to livestock as an additional food or income source. Livestock is both a blessing and a curse for agricultural biodiversity. It is important to maintain the generic variability of local varieties adapted to local conditions. However, livestock management is also a conservation challenge due to overgrazing and the resulting habitat degradation (soil erosion, compaction, reduced ability of forests to regenerate) as well as animal's consumption of forest resources for fodder. If adopting an agro-ecosystems approach, one could include the multiple farm inputs and resource flows, including livestock management and their waste.

7.2.2.3 Climate Change Adaptation - Food Security and Water

Given the fundamental ecosystem dependence of agriculture systems, including water services, climate change is likely to exacerbate vulnerabilities, making future food security even more uncertain. Climate change adaptation needs to be mainstreamed into water management and agricultural planning to ensure food security targets. Improving resilience through an ecosystem approach may reduce the vulnerability of food production to climate change. Land management and tree cover in catchment areas can play a critical role in water yield and sediment flow. In addition, efforts to improve the ability to deal with current rainfall variability and extreme climate events through increased water storage, early warning systems, and better post-harvest processing and food storage will improve the capacity to adapt to future climate change. Strategies such as better management of soil moisture, enhancing aquifer storage, and promoting small-scale, community-based storage and water harvesting are suggested—not only to reduce negative impacts on ecosystem services but also to provide greater direct benefits to the rural poor.

The convergence of climate change adaptation and water - which affect food security -reinforces the fact that both are salient relevant to the sector and suggests that it is advisable to use an integrated approach to ecosystem services (agro-ecosystems in the case of food security) that looks holistically at the water, climate, and other underlying biophysical supports to the agricultural system.

7.2.3 Health

In a very fundamental sense, ecosystems are the planet's life-support systems for all forms of life. The needs of human biology for food, water, clean air, shelter and relative climatic constancy are basic and unalterable. The causal links between environmental change and human health are complex because they are often indirect, displaced in space and time, and dependent on a number of modifying forces. Biodiversity and ecosystem function as it relates to human health is closely linked with the issue of climate change, as many of the anticipated health risks of climate change are associated with changes in biodiversity (e.g. changes in populations and distribution of disease vectors, scarcity of fresh water, impacts on agricultural biodiversity and food resources etc.)

Under its health systems strengthening activities, the Health DO may consider a comprehensive approach to ecosystem health and human health that integrates or optimizes across each of the dimensions below or select those areas most aligned across the portfolio as a whole as a near-term starting point (perhaps nutrition, fuel, disease vector spread and management of wild species used in traditional medicines).

7.2.3.1 Disease Vectors

Biodiversity and forests are absolutely vital to preventing disease and sustaining good health. Many human diseases have originated in animals, and so changes in the habitats of animal populations that are disease vectors or reservoirs may affect human health. For example, the Nipah virus is believed to have emerged after forest clearance fires in Indonesia drove carrier bats to neighboring Malaysia, where the virus infected intensively farmed pigs, and then crossed to humans. Intensive livestock production, while providing benefits to health in terms of improved nutrition, has also created environments favorable to the emergence of diseases. Increased human contact with wild species and "bush meat" as a result of encroachment in forests and changes in diet also create opportunities for disease transmission. Trends ranging from forest clearance to climate-induced habitat changes also appear to have impacted certain populations of mosquitoes, ticks and midges, altering transmission patterns for diseases like malaria and Lyme disease. The species most likely to disappear are those that buffer against infectious disease transmission, while surviving species tend to be the ones that increase disease transmission, such as that of West Nile Virus, Lyme disease and Hantavirus, according to a study done by the Environment of the Atkinson Center for a Sustainable Future (ACSF) at Cornell University which supports targeted research on biodiversity and disease. In India, the fall of the vulture population, listed as critically endangered, has reportedly exacerbated the spread of diseases like rabies; with no vultures to feed on the diseased animal remains, wild dogs and other scavengers move in, spreading the disease.

While the Mission's focus on health systems moves away from individual disease responses, health systems strengthening could include understanding the relationship between ecosystem health and human health, and consideration of climate-related disease vector spread.

7.2.3.2 Fuel (Cookstoves and Indoor Air Quality)

Nearly 70% of Indian households - accounting for 700 million people - depend on pollutant-rendering cook stoves that burn solid fuel, in the form of wood and or coal (Darragh, 2010). India is the world's largest consumer of fuelwood, with 40% of the population dependent on the fuelwood for fulfilling basic energy needs. It is estimated that 65% of the rural population and 22% of the urban population depend on fuelwood for cooking and fuelwood collection and sale constitute the source of livelihood for 11% of the population, making forests the single largest employer in the energy sector (TERI, 2006). The generation of power causes a range of health impacts. Outdoor air pollution aggravates heart and lung disease. Indoor air pollution, most typically from the combustion of biofuel in poorly ventilated heating and cooking environments causes a major burden of respiratory diseases amongst adults and children and exposes inhabitants to emissions that increase the chance of developing cataracts, pneumonia, and tuberculosis. The World Health Organization estimates that indoor air pollution was the cause of death for more than 1.6 million people across the globe in the year 2000 alone. In India, an estimated 400,000-550,000 people die as a result of indoor air pollution each year. While use of inefficient, biomass cookstoves is primarily an indoor air quality concern, there is a secondary impact on forest resources due to the heavy fuel wood requirements. In areas where the demand for wood has surpassed local supply and where people cannot afford other forms of power, there is increased vulnerability to illness and malnutrition from consuming microbiologically contaminated water, from exposure to cold, and from a lack of properly cooked food. Poor women and children in rural communities are often the most affected by fuelwood scarcity. Adequate energy supplies are fundamental for basic health needs and sustainable development.

As cooking food and heating water is a direct input to nutrition and avoidance of waterborne diseases as well as a potential source of indoor air pollution, the Health DO may advance rural energy systems and cooking/heating technologies that reduce use of indoor wood burning to improve indoor air quality

7.2.3.3 Medicine and Pharmaceuticals

India has one of the world's richest medicinal plant heritages. Several studies indicate that India ranks first in percent of flora that contains active medicinal ingredients, with estimates that 20% Indian plant species have medicinal value (compared to the world average of 12.5%). According to an all India ethno-botanical survey carried out by MoEF, over 8000 species of plants are being used by the people of India, with 90-95% of these coming from forests. Nearly 90% of the medicinal plants in trade are harvested from the wild. The medicinal plants constitute critical resource for health care of rural communities and for the growth of Indian herbal industry. Currently, India's share in the complementary medicine related global market is only 0.3% and there exists immense scope for expanding its share in the US\$ 62 billion world market from the present level of approximately US\$ 1.2 billion (NBAP 2009). A significant proportion of drugs are derived, directly or indirectly, from biological sources: at least 50% of the pharmaceutical compounds on the United States market are derived from plants, animals, and micro-organisms, while about 80% of the world population depends on medicines from nature (used in either modern or traditional medical practice) for primary healthcare. Traditional medicine such as Ayurveda in India and Traditional Chinese Medicine in China rely heavily on natural species. While there is a preference for wild species, unsustainable usage of medical species and inappropriate bio-prospecting represents particular conservation challenges, with meeting Chinese demand a significant source of illegal international animal trade.

The program may indirectly reduce pressure on wild medicinal species by providing financing and access to more modern health services to vulnerable populations. In addition, the approach could make a more explicit focus on the traditional medicine sector, supporting the formalization and controls for the cultivation and quality of medicinal species of plants and animals used in traditional medicine formulations, thereby reducing pressure on these resources. This approach would likely require a multiple ministerial collaboration including the Ministry of Health and Family Welfare under the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry of Environment and Forests, and Ministry of Agriculture. Natural medicine is an area identified as having a large economic potential, likely with livelihood benefits to local populations, and a possible area of collaboration under a public-private partnership with significant science and technology focus.

7.2.3.4 Potable Water

Access to potable water is fundamental to avoid diarrheal disease thereby access nutritional value from food. The growing demand and scarcity of drinkable water presents severe challenges to the future of human health. Every year, unsafe water, coupled with a lack of basic sanitation, kills at least 1.6 million children under the age of five years (UNICEF). India has made significant progress in attaining its Millennium Development Goals (MDGs) target for drinking water (providing 84 percent of its rural population with access to improved sources of water), although the country is facing a tremendous challenge in sustaining drinking water security in rural areas as most water sources are ground water based and have been overexploited for agriculture and industry as well as being subjected to contamination.

The health dimension of potable water is closely related to water resource management with possible collaboration for on-farm (as related to the Food Security DO) as well as watershed management as may be relevant under the forestry and sustainable landscapes activities (under the Climate Change DO).

8. IMPACT OF RELEVANT USAID/INDIA PROGRAMS ON FORESTRY AND BIODIVERSITY CONSERVATION

Of the 46 active USAID/India programs/activities, 23 continue beyond September 2012. In addition there are 11 programs/activities that are in the pipeline and expected to be awarded by September 2012. The list of these 34 (23 ongoing + 11 pipeline) programs/activities is presented in the table below:

No	Programs/ Activities continuing beyond September 2012	Sector
1	Cereal Systems Initiative for South Asia (CSISA)	Agriculture
2	Agriculture Innovations Partnership (AIP)	Agriculture
3	Development Credit Authority (DCA) - YES Bank	Clean technology
4	PAPA / US Forest Service	Forestry
5	Self-Employed Women's Association (SEWA)	Governance
6	AIDSTAR One	Health
7	India Tuberculosis (TB) Project	Health
8	TREAT (Technology, Research, Education and Technical Assistance for Tuberculosis) TB Program	Health
9	Support to TB Control in India (STOP-TB)	Health
10	CORE Group Polio Project (CGPP)	Health
11	Polio Eradication Project	Health
12	National Polio Surveillance Project	Health
13	The Fertility Awareness-Based Methods (FAM) Project	Health
14	Program Research for Strengthening Services (PROGRESS/India)	Health
15	Improving Healthy Behaviors Project in India (IHBP)	Health
16	MEASURE DHS/ ICF Macro -National Family Health Survey IV National Family Health Survey (NFHS) IV	Health
17	Health Policy Project (HPP) Task Order 1	Health
18	Innovations in Family Planning Services (IFPS)	Health
19	Health of the Urban Poor (HUP)	Health
20	Strengthening Health Outcomes through the Private Sector (SHOPS)	Health
21	Development Credit Authority (DCA) - Water and Sanitation Pooled Fund (WSPF), Karnataka	Water
22	Development Credit Authority (DCA) - Water and Sanitation Pooled Fund (WSPF), Tamil Nadu	Water
23	Water Analysis, Innovations and Systems Program (WAISP): DAI	Water
No	Program/ Activities expected to be active by September 2012	Sector
1	Water-Agriculture-Livelihood security in India – CIPT	Agriculture
2	Partnership to Advance Clean Energy – Deployment (PACE-D)	Clean energy
3	wPower	Clean energy

4	SARI/ Energy Integration	Energy
5	Partnership For Land Use Science (Forest-PLUS)	Forestry
6	Partnership: Impact through Prevention, Private Sector and Evidence-based Programming (PIPPSE)	Health
7	South-to-South Partnership	Health
8	Center of Excellence for Market-based Partnerships for Health (COE)	Health
9	Health Systems Advanced through TA	Health
10	FICCI-Millennium Alliance (MA)	Multi-sector (Clean energy, water, health)
11	Promoting water use efficiency across urban sector	Water

The Initial Environmental Evaluation (IEE) of these 34 programs/activities was reviewed with the Mission Environmental Officer (MEO). In addition to that discussions were also held with the relevant technical offices and contracting office.

Of all the 34 listed programs/activities listed above, only six appear to have significant linkages with forestry and biodiversity:

8.1.1 Partnership to Advance Clean Energy – Deployment (PACE-D)

PACE-D aims to accelerate India's transition to a high performing, low emissions and energy secure economy. The program will work on three key components/activities:

- Energy Efficiency (EE): Scaling up and deploying energy efficient technologies, especially smart grid, Net Zero Building, Waste Heat Utilization and HVAC etc. This will be achieved by strengthening regulatory and policy environment, increasing innovative financing, and building capacity to implement EE programs.
- Renewable Energy (RE): Increased supply of renewable energy technologies to drive down costs towards grid parity and expand cost-effective off grid RE technology. The activities under this component include strengthening policy and regulatory framework of few states, deployment of off-grid technologies, development of innovative financing, capacity building, regulator training and micro-financing component.
- Cleaner Fossil and Technologies: Accelerate the capacity for development of low carbon, cleaner fossil technologies with the purpose to reduce or avoid GHG emissions. This would be achieved through improving heat rate trends of existing power plants, developing a concept of model power plant, establishing a network of service provider as well as capacity building.

8.1.2 FICCI-Millennium Alliance (MA)

Through the MA project, USAID will strengthen the capacity of the key implementing partner, the Federation of Indian Chambers of Commerce and Industry (FICCI) to establish an Indian-owned and operated, multi-contributor platform to identify, support, and scale innovative, game-changing, and cost-effective solutions to base of the pyramid development challenges in India

and around the world. USAID and FICCI will pool their resources to provide financial support (primarily in the form of grants) for innovations in agriculture, clean energy, education (early grade reading), water and sanitation, and health. A portion of USAID's funding will be used to showcase the innovations and build the capacity of FICCI to operate the "Development Innovation Fund".

8.1.3 wPower

wPower aims to develop a model, scalable public-private partnership to promote sustainable energy access and build and strengthen networks of women, clean energy, entrepreneurs across India. The project will integrate women into the supply chain by linking women's distribution networks to manufacturers of small-scale clean technologies. Other activities would include facilitating access to financing, as well as entrepreneurship training and capacity building. Training modules will focus on clean energy technologies and applications that are relevant to the targeted needs of women in household use and for productive applications.

8.1.4 Water-Agriculture-Livelihood security in India

The goal of the program is to promote climate change adaptation and water sustainability while improving farmer livelihood and food security in three key regions in India. The objectives are (i) to develop and implement a public-private partnership to provide modern extension services to farmers in Punjab, Gujarat and Bihar for climate and market informed crop choice and irrigation improvements to improve water productivity, income and climate risk management; (ii) Considering both chronic risk from groundwater depletion and seasonal floods and droughts, develop and apply targeted risk prediction and management tools, including pilots and policy initiatives. The activities include energy sector reforms with respect to agricultural usage, pilots and demonstrations (such as better cultivation practices, water conservation, energy conservation, etc.)

8.1.5 Cereal Systems Initiative for South Asia (CSISA)

CSISA aims to accelerate the development and deployment of improved rice, wheat, and maize varieties, the staple food to the majority of the population in the Indo-Gangetic plains as well as promoting sustainable cropping systems and improved natural resource management in agriculture. CSISA would disseminate a number of conservation agriculture technologies including direct seeded rice, soil health and nutrient management methods, crop residue management, and new cropping systems along with technologies that improve farmer's access to information.

8.1.6 Water Analysis, Innovations and Systems Program (WAISP)

WAISP includes analytic and field implementation components in the water sector to achieve tangible outcomes in the short-term, while laying the groundwork for potential longer term investment by USAID/India in the water sector. While the first component of WAISP was a broad-based water assessment of the water sector in India, the second component focuses on development of scalable models for water use efficiencies in the municipal and industrial sectors. The program essentially focuses in urban areas.

Impacts

Although the six above listed programs/activities have the potential, there is very little risk of significant negative impacts on forests and biodiversity conservation. These programs/activities include developing demonstration pilots for decentralized off-grid renewable energy systems, clean energy systems, agricultural systems and water use efficiency. The agriculture project (i.e., CSISA) will undertake pilots only in agricultural areas and completely avoid closed forest area. The demonstration pilots under the energy programs, especially the off-grid projects in rural areas, may have insignificant impact if set up in forested area. On the other hand, energy projects involving improved cookstoves would have a positive impact by reducing the pressure on forests and the biodiversity harbored by the forests. The pilots under the water program and under DCA will largely focus on urban areas. The MEO along with the technical offices will closely monitor these projects to assess the impacts on forests and biodiversity during the implementation of the projects. If any of the projects are found to have any significant impacts, Environmental Monitoring and Mitigation Plan (EMMP) will be developed and the relevant training will be provided to the implementation partners.

It might be useful to also mention the **WWF SCAPES transboundary project** in the Sacred Himalayan Landscape (SHL) being supported by USAID/Washington. The overall goal of the SCAPES program in the region is “to create a Himalayan landscape where the biological and cultural treasures of the world’s highest sacred mountains and deepest valleys are safeguarded while people’s rights over resources are ensured and livelihoods are enhanced and sustained.” SHL includes two globally important contiguous ecoregions: the Eastern Himalayan Alpine Scrub and Meadows, and the Eastern Himalayan Broadleaf and Conifer Forests. The program is expected to have a positive impact on tropical forest and biodiversity. Conservation targets for the SCAPES program in the Sacred Himalayan Landscape have been identified as: alpine meadows and shrubs; coniferous forests; broadleaf forests; glaciers and glacier lakes; musk deer; red panda; snow leopard; non-timber forest products (NTFPs) and medicinal and aromatic plants (MAPs). USAID’s support will be concentrated on securing the east-west connectivity between the Kangchenjunga Conservation Area in Nepal and Kangchendzonga Biosphere Reserve in Sikkim, India, and north-south connectivity between some of the last remaining areas of subtropical and temperate forests outside protected areas.

9. USAID/INDIA INTERVENTIONS IN THE FORESTRY/ BIODIVERSITY SECTOR

9.1 Partnership for Land Use Science (Forest-PLUS)

The five-year Partnership for Land Use Science (Forest-PLUS) program will support GOI's 'Green India Mission'. The program aims to reduce emissions and enhance carbon sequestration through India's forests by taking REDD+ actions to scale. USAID will work in close collaboration with MoEF, local governments, and local communities. USAID will work with these stakeholders to adapt cutting-edge innovations and practices in India, and build the capacity of local stakeholders to better manage India's forest resources. These management practices will demonstrate how India can improve the health and productivity of select forests to reduce carbon emissions.

The program is divided into 2 components. Component one focuses on U.S.-India collaborative scientific research and exchanges that explore methods and approaches to implement REDD+. This will be vital for India's own programs and will further demonstrate India's advances in science and technology to develop lessons that may be applied in other developing countries. Component one will focus on three tasks:

1.1 Developing tools and methods for improved ecosystem management

This task entails developing silviculture tools and management techniques that promote carbon sequestration while, at the same time, optimizing ecological (e.g. water filtration, conservation) and livelihood benefits. Emphasis would also be laid on grazing management and sustainable harvest of Non-Timber Forest Products (NTFPs).

1.2 Developing methods to conduct carbon inventories and create carbon stock baselines

Under this task, methodologies for estimating carbon content of different forest types would be developed, including software models that convert remote sensing data into carbon estimates. Other important aspects include strengthening national greenhouse gas inventory data management system related to forests, developing protocols for community involvement in forest carbon inventories, and design of data management systems and technologies that collate community-based data collection and feed it into the national database.

1.3 Analyzing social and economic incentives for improved forest management

REDD+ and carbon markets may provide direct financial incentives, yet there are other important incentives related to local livelihoods that merit research. These incentives include other forms of livelihood support such as improving the value chain for NTFPs, and increasing access to clean energy and/or improved cookstoves. These improvements would enable communities to maintain and increase forest carbon stocks by potentially reducing their dependence on forest subsistence activities, and demand for fuelwood.

Under component two, cost-effective, geographically relevant and culturally appropriate methods and approaches will be piloted in the field at scales that lend the results and learning to replication at higher levels. Component two focuses on three tasks:

2.1 Establishing government and stakeholder dialogue and communication processes

The program will work with MoEF to initiate interactive dialogues with stakeholders about climate change, and the types of research the Forest-PLUS program will be carrying out. The dialogues will generate feedback from the stakeholders that is expected to improve research design, deployment and application.

2.2 Engaging stakeholders constructively in REDD+ implementation

The program will work with various stakeholders on piloting of methodologies and research results. Primary stakeholders include communities and local government. They may also include students and university professors involved in field testing research and evaluating results obtained in the field, as well as partnerships with the private sector.

2.3 Strengthening human and institutional capacity and the enabling environment

The program will build the capacity of MoEF scientists and administrators at the national level, priority forestry administrators at the state and local levels (state-level forestry staff and members of village JFMCs), and community level stakeholders to implement improved ecosystem management practices, carbon inventory, and set in place appropriate incentives.

These efforts to improve carbon sequestration from forests under this program will benefit forest conservation at large and the biodiversity it contains within. For examples, most of the large forested landscapes in India are tiger habitats, and conservation of these forest landscapes would help in conservation of tigers and other species down the food chain.

9.2 US Forest Service PAPA

USAID's interagency agreement with US Forest Service builds upon scientific and technical collaboration and exchange envisioned under USAID's Forest-PLUS program. This five-year activity also builds upon previous and ongoing work being undertaken by US Forest Service in forestry sector in India. Purpose of these sets of activities is to build capacity of MoEF to take REDD+ actions to scale.

Phase 1: Conducting trainings to bolster Indian expertise in completing carbon estimations, forest inventories, and related analyses.

1.1 Remote sensing applications to map and estimate forest cover, and estimate burn severity: Program will expose participants to remote sensing tools, technologies and applications; train on monitoring trends and burn severity applications to help enable setting up a similar program in India.

1.2 Forest inventory and monitoring: Program will expose participants to tools and techniques for forest and carbon inventories and analyses. Training will also make available the most useful applications and tools on forest and carbon inventories to be modified for use in India.

1.3 Establishing baselines/reference levels: Training workshop on scenario development and modeling for baseline estimation for REDD+.

1.4 Assessment of institutional capacities and organizational capabilities for implementing REDD+ : The study would suggest institutional mechanisms, structures, and business models for operationalizing REDD+ in India. It will also look into parameters to be included in national inventory for REDD+ reporting.

Phase 2: Set up pilot projects to demonstrate methodologies, tools and technologies in Indian context. Activities in Phase 2 will build upon momentum generated during Phase 1 to implement and improve data collection and decision-making tools for forest resources (including carbon) assessments, and monitoring & management at multiple scales.

2.1 Pilot testing carbon estimation methodologies: Focus would be on testing and developing integrated carbon estimation methodologies that work in the Indian context; and that can be scaled up from a local level in Uttarakhand to the national level.

2.2 Pilot project for carbon estimations in mangrove systems of India: Focus would be on applying methodologies for inventorying and monitoring the mangroves of the Indian Sundarbans.

9.3 Other Forestry Programs/Activities

USAID will invest a part of Global Climate Change funds into a new grant that advances development innovations in the forestry sector. As currently envisioned, this mechanism will create a platform to support scientific research on valuation of ecosystems services (e.g. maintaining water supply and quality, maintaining biodiversity and critical species, and resilience to climate change). This grant may be modeled on the new agency-wide platforms such as prizes or research-oriented grants such as the Partnerships for Enhanced Engagement in Research (PEER) program. The research will enhance GOI's understanding of ecosystem services, and subsequently facilitate the long-term implementation of payments for ecosystems services. This is also expected to result in better allocation of resources to the forestry sector by the GOI. This could ultimately improve forest management and forest health, leading to reduced emissions from forests, and enhanced carbon sequestration. This mechanism may be implemented by GOI forest research organizations and/or non-government organizations.

9.4 Cross-border Tiger Conservation

USAID/India is exploring opportunities for cross border tiger conservation (India and Bangladesh) with funding from the Asia Regional Bureau.

9.5 Water

To promote climate change adaptation and water sustainability while improving farmer livelihoods and food security, USAID is starting a Water-Agriculture-Livelihood Security project in India. The project would develop a public-private partnership to provide modern extension services to farmers for climate and market informed crop choice and irrigation improvements to improve water productivity, increase income, and promote climate-risk management.

9.6 Clean Energy

USAID/India clean energy programs look into improving use and efficiency of biomass based energy technologies since use of inefficient energy biomass-based sources impact on forestry resources and the biodiversity harbored by the forests. USAID/India is supporting work in promoting advanced cook stoves by rural communities to improve indoor air pollution through more efficient fuel consumption (largely biomass). PACE-D program will support approaches to overcome barriers to rural electrification and decentralized RE generation. Biomass based RE technologies are the most predominantly used technologies for rural electrification. The Microfinance Support program under PACE-D will enhance capacity of MFI's in providing energy services to underserved rural areas.

INDIA TROPICAL FOREST & BIODIVERSITY ANALYSIS (FAA 118/119)

APPENDICES

Appendix A : Introduction to Ecosystem Services and Values of Biodiversity and Forests

In addition to the ecological and genetic biophysical values of India's biological diversity and tropical forests, these ecosystems also provide multiple social, economic, scientific, educational, cultural, recreational and aesthetic values. The failure to account for the full economic values of ecosystems and biodiversity is a significant factor in their continuing loss and degradation.

While there have been efforts at quantifying the economic value of various ecosystem services, one of the most promising and comprehensive initiatives underway is The Economics of Ecosystems and Biodiversity (TEEB) hosted by the United Nations Environment Programme. The objective of the TEEB study is to initiate the process of analyzing the global economic benefit of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation, and to draw together expertise from the fields of science, economics and policy to enable practical conservation actions. The synthesis report released in 2010 indicates that factoring the planet's multi-trillion dollar ecosystem services into policy making can help cities and regional authorities save money while boosting the local economy, enhancing quality of life, securing livelihoods and generating employment.

Ecosystem services consist of the flows of value to human societies as a result of the state and quantity of natural capital. The Millennium Ecosystem Assessment defines four categories of ecosystem services that contribute to human well-being, each underpinned by biodiversity

- **Provisioning services** – for example wild foods, crops, fresh water and plant-derived medicines;
- **Regulating services** – for example filtration of pollutants by wetlands, climate regulation through carbon storage and water cycling, pollination and protection from disasters;
- **Cultural services** – for example recreation, spiritual and aesthetic values, education;
- **Supporting services** – for example soil formation, photosynthesis, and nutrient cycling.

TEEB examples of the valuation of ecosystems services include:

- **US\$50bn - The annual loss of opportunity due to the current over-exploitation of global fisheries.** Competition between highly subsidized industrial fishing fleets coupled with poor regulation and weak enforcement of existing rules has led to over-exploitation of most commercially valuable fish stocks, reducing the income from global marine fisheries by US\$50bn annually, compared with a more sustainable fishing scenario (World Bank and FAO 2009).
- **€153bn - Insect pollinators are nature's multibillion-dollar providers.** For 2005 the total economic value of insect pollination was estimated at €153bn. This represents 9.5% of world agricultural output for human food in 2005 (Gallai et al 2009)
- **US\$30bn - 172bn - The annual value of human welfare benefits provided by coral reefs.** Although just covering 1.2% of the world's continent shelves, coral reefs are home to an estimated 1-3 million species including more than a quarter of all marine fish species (Allsopp et al 2009). Thirty million people in coastal and island communities are totally reliant on reef-based resources as their primary means of food production, income and livelihood (Gomez et al 1994, Wilkinson 2004). Estimates of the value of human welfare benefits provided by coral reefs range from US\$30bn (Cesar et al 2003) to US\$172bn annually (Martinez et al 2007)
- **US\$ 20-67m (over four years) - The benefits of tree planting in the city of Canberra.** Local authorities in Canberra, Australia, have planted 400,000 trees to regulate microclimate, reduce pollution and thereby improve urban air quality, reduce energy costs for air conditioning as well as store and sequester carbon. These benefits are expected to amount to US\$20-67m over the period 2008-2012, in terms of the value generated or savings realized for the City (Brack 2002).
- **US\$6.5bn – The amount saved by New York, by investing in payments to maintain natural water purification services in the Catskills watershed** (US\$1-1.5bn) rather than opt for the man-made solution of a filtration plant (US\$6-8bn plus US\$ 300-500m a year operating costs). (Perrot-Maitre and Davis 2001).
- **50 - The number of (rupees) millionaires in Hiware Bazaar, India** as the result of regenerating 70 hectares of degraded forests. This led to the number of active wells in the surrounding area doubling, grass production increasing and income from agriculture increasing due to the enhancement of local ecosystem services (TEEB 2010).

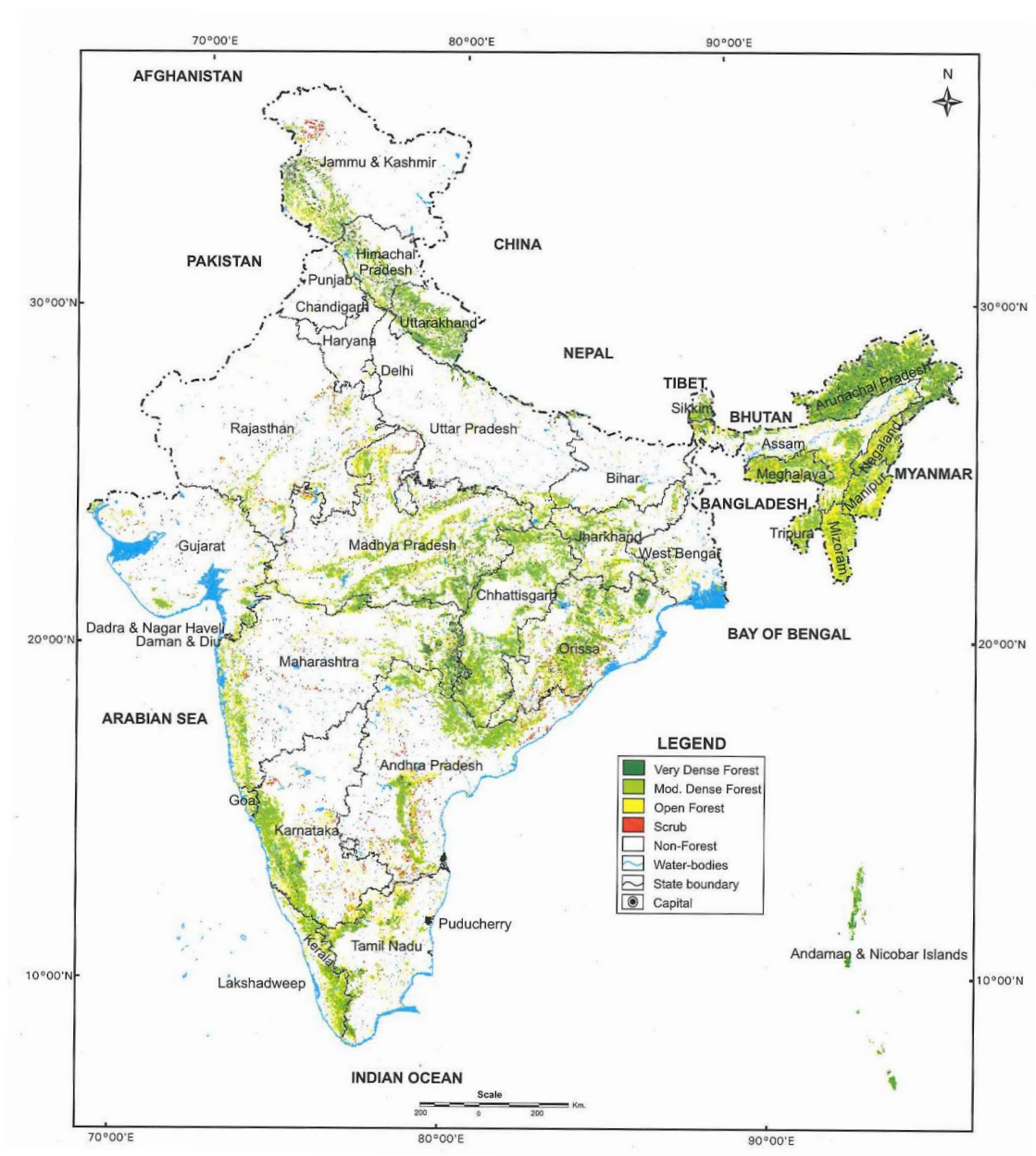
While TEEB is a global study, it is significant to India since in 2010 India announced its intention to become the first country in the world conduct its own TEEB study and publish a new set of accounts which track the nation's plants, animals, water, and other "natural wealth" as well as financial measurements such as GDP. This appraisal of ecosystem services is essentially a green accounting exercise that is crucial to the transition to a low carbon, resource efficient green economy and it is hoped that such a move by a major developing economy will prompt other countries to join the initiative. The Indian TEEB launch event was organized by the TEEB study, Ministry of Environment and Forests, Indian Institute of Technology Bombay, Green India States Trust (GIST) and International Council for Local Environmental Initiatives (ICLEI) South Asia.

Appendix B : List of Wetlands of International Importance in India (Ramsar Sites)

Ramsar Sites in India			
Site Name	Date of Designation	Region, State, or Province	Area in Hectares
Ashtamudi Wetland	19/08/02	Kerala	61,400
Bhitarkanika Mangroves	19/08/02	Orissa	65,000
Bhoj Wetland	19/08/02	Madhya Pradesh	3,201
Chandertal Wetland	08/11/05	Himachal Pradesh	49
Chilika Lake	01/10/81	Orissa	116,500
Deepor Beel	19/08/02	Assam	4,000
East Calcutta Wetlands	19/08/02	West Bengal	12,500
Harike Lake	23/03/90	Punjab	4,100
Hokera Wetland	08/11/05	Jammu & Kashmir	1,375
Kanjli	22/01/02	Punjab	183
Keoladeo National Park	01/10/81	Rajasthan	2,873
Kolleru Lake	19/08/02	Andhra Pradesh	90,100
Loktak Lake	23/03/90	Manipur	26,600
Point Calimere Wildlife and Bird Sanctuary	19/08/02	Tamil Nadu	38,500
Pong Dam Lake	19/08/02	Himachal Pradesh	15,662
Renuka Wetland	08/11/05	Himachal Pradesh	20
Ropar	22/01/02	Punjab	1,365
Rudrasagar Lake	08/11/05	Tripura	240
Sambhar Lake	23/03/90	Rajasthan	24,000
Sasthamkotta Lake	19/08/02	Kerala	373
Surinsar-Mansar Lakes	08/11/05	Jammu & Kashmir	350
Tsomoriri	19/08/02	Jammu & Kashmir	12,000
Upper Ganga River (Brijghat to Narora Stretch)	08/11/05	Uttar Pradesh	26,590
Vembanad-Kol Wetland	19/08/02	Kerala	151,250
Wular Lake	23/03/90	Jammu & Kashmir	18,900

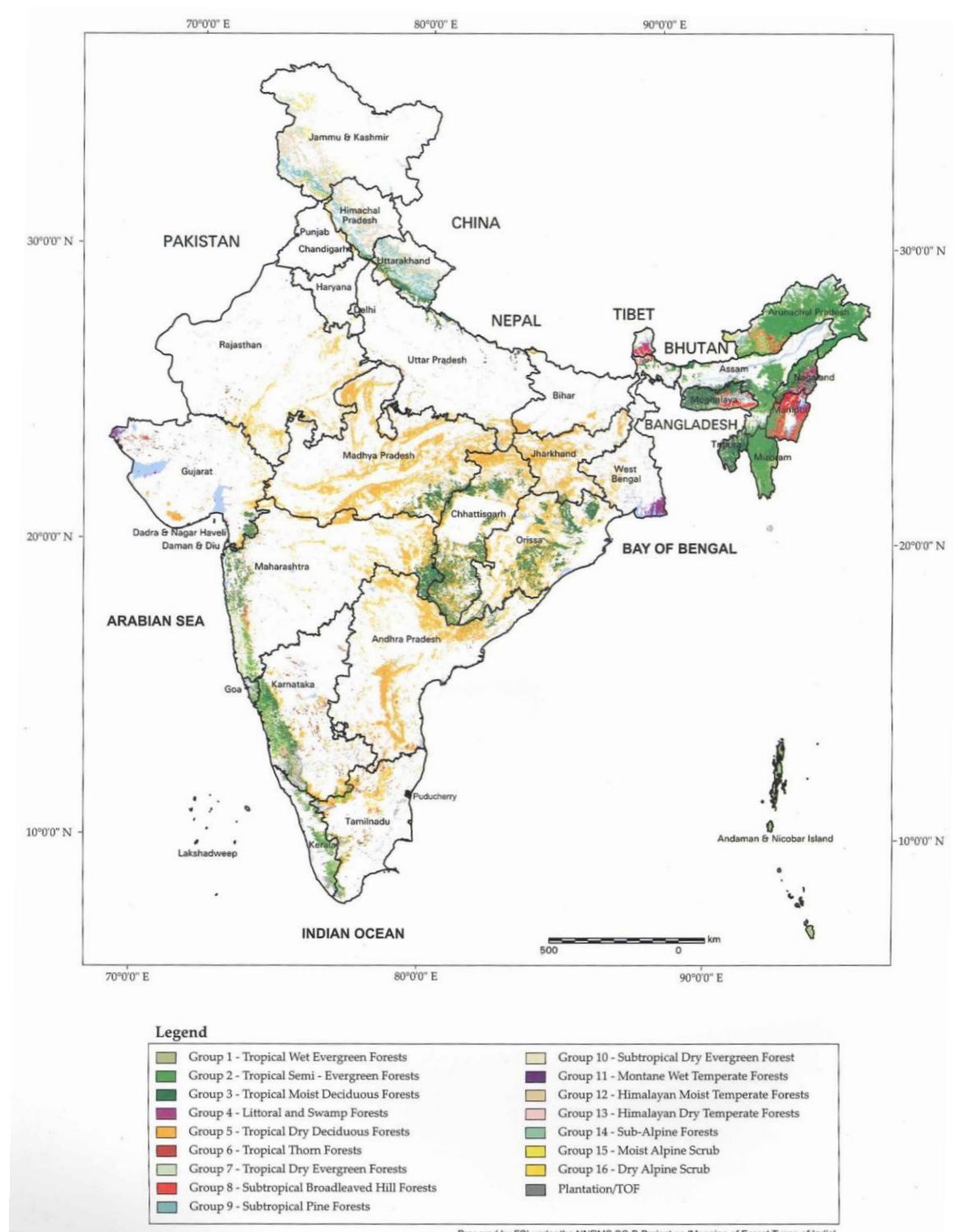
Source: <http://www.ramsar.org> (2012)

Appendix C : Map of Forest Cover of India (2011)



Source: India State of Forest Report (FSI, 2011)

Appendix D : Map of Forest Cover of India by Forest Type (2011)

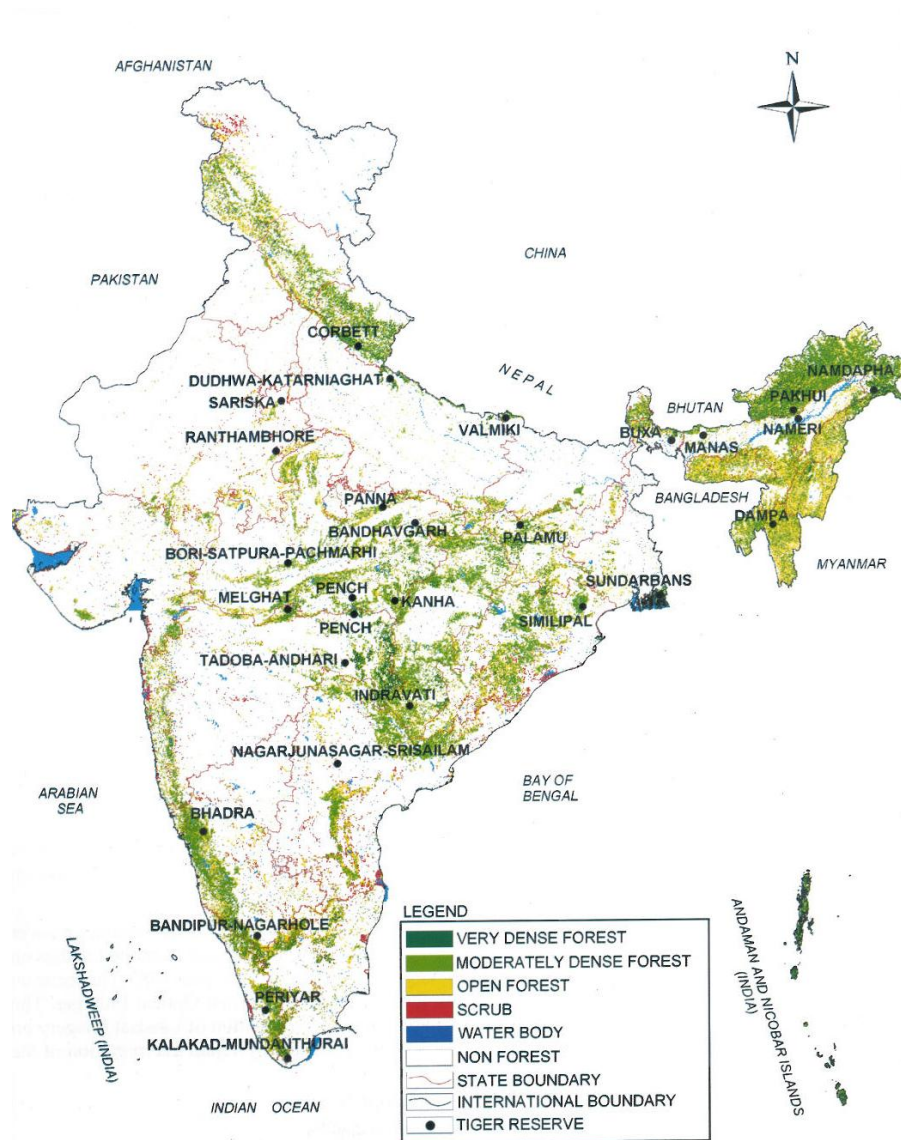


Source: Atlas: Forest Types of India (FSI, 2011)

Area under different forest type groups of India	
Forest Group	Percent of Forest Cover
Group 1 – Tropical Wet Evergreen Forest	2.92
Group 2 – Tropical Semi-Evergreen Forest	13.79
Group 3 – Tropical Moist Deciduous Forest	19.73
Group 4 – Littoral and Swamp Forest	0.69
Group 5 – Tropical Dry Deciduous Forest	41.87
Group 6 – Tropical Thorn Forest	2.25
Group 7 – Tropical Dry Evergreen Forest	0.13
Group 8 – Subtropical Broadleaved Hill Forest	2.69
Group 9 – Subtropical Pine Forest	2.63
Group 10 – Subtropical Dry Evergreen Forest	0.03
Group 11 – Montane Wet Temperate Forest	0.69
Group 12 – Himalayan Moist Temperate Forest	4.12
Group 13 – Himalayan Dry Temperate Forest	0.84
Group 14,15,16 – Sub Alpine and Alpine Forest	2.55
Plantation/Trees Outside Forests	5.07
Total	100.00

Source: Atlas: Forest Types of India (FSI, 2011)

Appendix E : Map of tiger reserves in India



Appendix F : Recorded Plant and Animal Species in India

Recorded plant species			
Taxonomic group	Number of species		India's % of world flora
	World	India	
Angiosperms	250000	17500	7.0
Gymnosperms	650	48	7.4
Pteridophytes	10000	1200	12.0
Bryophytes	14500	2850	19.7
Lichens	13500	2075	15.0
Fungi	70000	14500	20.7
Algae	40000	6500	16.3
Virus/Bacteria	8050	850	10.6
Total	40670	45523	11.8

Source: India's Third National Report to CBD, 2006; NBAP, 2008

Recorded Animal Species			
Taxonomic Group	Number of Species		India's % of world Fauna
	World	India	
Protista (Protozoa)	31250	2577	8.24
ANIMALIA			
Mesozoa	71	10	14.08
Porifera	4562	500	10.70
Cnidaria	9916	842	8.49
Ctenophora	100	12	12.00
Platyhelminthes	17500	1622	9.22
Nemertinea	600	-	-
Rotifera	2500	330	13.20
Gastrotricha	3000	100	3.33
Kinorhyncha	100	10	10.00
Nematoda	30000	2850	9.50
Nematomorpha	250	-	-
Acanthocephala	800	229	28.62
Sipuncula	145	35	24.14
Mollusca	66535	5072	7.62
Echiura	127	43	33.86
Annelida	12700	840	6.61
Onychophora	100	1	1.00
Arthropoda	970670	69903	7.20

Crustacea	35534	2934	8.26
Insecta	861696	61151	7.10
Arachnida	73440	5818	7.90
Pycnogonida	600	16	2.67
Paupoda	360	-	-
Chilopoda	3000	100	3.33
Diplopoda	7500	162	2.16
Symphyla	120	4	3.33
Merostomata	4	2	50.00
Phoronida	11	3	27.27
Bryozoa (Ectoprocta)	4000	200	5.00
Entoprocta	60	10	16.66
Brachiopoda	300	3	1.00
Pogonophora	80	-	-
Priapulida	8	-	-
Pentastomida	70	-	-
Chaetognatha	111	30	27.02
Tardigrada	514	30	5.83
Echinodermata	6223	765	12.29
Hemichordata	120	12	10.00
Chordata	48451	4994	10.40
Protochordata	2106	119	5.65
Pisces	21723	2546	11.72
Amphibia	5150	240	4.66
Reptilia	5817	460	7.91
Aves	9026	1232	13.66
Mammalia	4629	397	8.58
Total (Animalia)	1191208	88730	7.45
Grand Total (Protista+ Animalia)	1222458	91307	7.46

Source: NBAP 2008

Definitions:

- **Protistas** do not have much in common besides a relatively simple organization—either they are unicellular, or they are multicellular without specialized tissues. This simple cellular organization distinguishes the protistas from other eukaryotes, such as fungi, animals and plants.
- **Animalia** is the taxonomic kingdom comprising all animals (including human beings).
- **Arthropods** are an invertebrate animal having an exoskeleton (external skeleton), a segmented body, and jointed appendages and include the insects, arachnids, crustaceans, and others.
- **Chordata** includes the well-known vertebrates (fishes, amphibians, reptiles, birds, mammals).

Appendix G : List of Critically Endangered Species in India

List of Critically Endangered Bird Species

1. *Ardea insignis* (White-bellied Heron)
2. *Eurynorhynchus pygmeus* (Spoon-billed Sandpiper)
3. *Grus leucogeranus* (Siberian Crane)
4. *Gyps bengalensis* (White-rumped Vulture)
5. *Gyps indicus* (Indian Vulture)
6. *Gyps tenuirostris* (Slender-billed Vulture)
7. *Heteroglaux blewitti* (Forest Owlet)
8. *Houbaropsis bengalensis* (Bengal Florican)
9. *Ophrysia superciliosa* (Himalayan Quail)
10. *Rhinoptilus bitorquatus* (Jerdon's Courser)
11. *Rhodonessa caryophyllacea* (Pink-headed Duck)
12. *Sarcogyps calvus* (Red-headed Vulture)
13. *Vanellus gregarius* (Sociable Lapwing)

List of Critically Endangered Animal Species (Mammals, Reptiles, Amphibians and Fishes)

1. *Anoxypristis cuspidata* (Knifetooth Sawfish)
2. *Batagur baska* (Four-toed Terrapin)
3. *Batagur kachuga* (Red-crowned Roofed Turtle)
4. *Biswamoyopterus biswasi* (Namdapha Flying Squirrel)
5. *Carcharhinus hemiodon* (Pondicherry Shark)
6. *Cremnomys elvira* (Large Rock-rat)
7. *Crocidura jenkinsi* (Jenkin's Shrew)
8. *Crocidura nicobarica* (Nicobar Shrew)
9. *Dermochelys coriacea* (Leatherback)
10. *Dicerorhinus sumatrensis* (Sumatran Rhinoceros)
11. *Eretmochelys imbricata* (Hawksbill Turtle)
12. *Fejervarya murthii*
13. *Gavialis gangeticus* (Fish-eating Crocodile)
14. *Glyphis gangeticus* (Ganges Shark)

15. *Indirana gundia*
16. *Indirana phrynoderma*
17. *Ingerana charlesdarwini*
18. *Labeo potail* (Deccan Labeo)
19. *Micrixalus kottigeharensis*
20. *Millardia kondana* (Kondana Rat)
21. *Philautus chalazodes*
22. *Philautus griet*
23. *Philautus ponmudi*
24. *Philautus sanctisilvaticus*
25. *Philautus shillongensis*
26. *Philautus* sp. nov. 'Amboli Forest'
27. *Philautus* sp. nov. 'Munnar'
28. *Porcula salvania* (Pygmy Hog)
29. *Pristis microdon* (Leichhardt's Sawfish)
30. *Pristis zijsron* (Narrowsnout Sawfish)
31. *Rhacophorus pseudomalabaricus*
32. *Rhinoceros sondaicus* (Javan Rhinoceros)
33. *Viverra civettina* (Malabar Civet)

Appendix H : Agricultural Biodiversity - List of wild relatives of crop plants and native breeds of domesticated animals

Wild relatives of crop plants in India	
Crop	Number of wild relatives
Cereals and millets	46
Pulses	81
Fruits	91
Spices and Condiments	28
Vegetables	76
Fiber crops	15
Oilseeds	14
Misc plants	28
Total	379

Indian native breeds of domesticated animals	
Group	Number
Cattle	30
Buffalo	10
Sheep	42
Goat	20
Camel	9
Horse	6
Donkey	2
Poultry	18
Total	137

Appendix I : Multilateral Environment Agreements Ratified by India

MEAs	Year	Entry into force	Ratified by India	Issues covered
Convention on Wetlands of International Importance	1971	1975	1982	Conservation and wise use of wetlands, primarily as habitat for the water-birds
Convention for the Protection of World Cultural and Natural Heritage	1972	1975	1977	Protection and conservation of cultural and natural heritage
Convention on International Trade in Endangered Species	1973	1975	1976	International trade in endangered species of wild fauna and flora
Bonn Convention on Migratory Species of Wild Animals	1979	1983	1983	Conservation, management and wise use of migratory species of wild animals and their habitats
Vienna Convention for Protection of the Ozone Layer	1985	1988	1991	Protection of atmospheric ozone layer above the planetary boundary layer
Montreal Protocol on Substances that Deplete the Ozone Layer	1987	1989	1992	Protection of atmospheric ozone layer above the planetary boundary layer
Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal	1989	1992	1992	Regulation of transboundary movements of hazardous wastes and their disposal
United Nations Framework Convention on Climate Change (UNFCCC)	1992	1994	1993	Changes in the earth's climate system due to anthropogenic interference
Kyoto Protocol to the UNFCCC	1997	2005	2002	Quantified emission limitation and reduction commitments for Annex I Parties
Convention on Biological Diversity	1992	1993	1994	Biological diversity and biological resources
Cartagena Protocol on Biosafety to the CBD	2000	2003	2003	Regulation of transboundary movement, transit, handling and use of living modified organisms
United Nations Convention to Combat Desertification	1994	1996	1996	Combating desertification and mitigate the effects of drought, particularly in Africa Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous
Chemicals and Pesticides in International Trade	1998	2004	2005	Promote shared responsibility and cooperative efforts among Parties in international trade of certain hazardous chemicals, in order to protect human health and environment from potential harm and to contribute to their environmentally sound use
Stockholm Convention on Persistent Organic Pollutants	2001	2004	2006	Protect human health and the environment from persistent organic pollutants

Appendix J : List of Principal Laws and Policies Affecting Conservation in India

Principal Laws and Policies Affecting Conservation in India		
Act or Policy	Year	Summary
Environmental		
Draft National Water Policy Document	2012	Currently in draft form for public consultation. Nodal agency is Ministry of Water Resources (MWR).
National Environment Policy	2006	<p>Calls for balance and harmony between economic, social and environmental needs of the country. Key principals include 1) Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature and 2) The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.</p> <p>Seeks to achieve balance and harmony between conservation and development. The policy is intended to mainstream environmental concerns in all development activities. The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well- being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resources. The NEP prescribes that human beings are at the center of concerns for sustainable development and they are entitled to a healthy and productive life in harmony with nature.</p>
National Water Policy	2002	Establishes high level policy guidance for all aspects of water management, including quality, participatory management, allocation priorities, etc.
National Conservation Strategy and Policy Statement on Environment and Development	1992	Broad policy statement on balancing environmental conservation within development agenda.
The Environment (Protection) Act	1986	Objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities [under section 3(3)] charged with the mandate of

		preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991.
The Water (Prevention and Control of Pollution) Act	1974	To provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988.
Biosphere Reserve Guidelines	2007	Protection, Development, Maintenance and Research in Biosphere Reserves in India
Forest Conservation		
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act	2006	Recognizes the rights of forest-dwelling Scheduled Tribes and other traditional forest dwellers over the forest areas inhabited by them and provides a framework for according the same.
Policy Statement on Abatement of Pollution	1992	Address pollution to water and air, with a focus on industrial pollution and hazardous waste.
National Forest Policy	1988	The principal aim is to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium, which are vital for sustenance of all life forms, human, animal and plant. The derivation of direct economic benefit must be sub-ordinated to this principal aim. The national goal should be to have a minimum of one-third of the total land area of the country under forest or tree cover. In the hills and in mountainous regions, the aim should be to maintain two-third of the area under such cover in order to prevent erosion and land degradation and to ensure the stability of the fragile ecosystem.
The Forest (Conservation) Act	1980	Enacted to help conserve the country's forests. It strictly restricts and regulates the de-reservation of forests or use of forest land for non-forest purposes without the prior approval of Central Government. To this end the Act lays down the pre-requisites for the conversion of forest land for non-forest purposes
The Indian Forest Act	1927	Consolidates the law relating to forests, the transit of forest-produce and the duty leviable on timber and other forest-produce.
Biodiversity and Wildlife		
The Biological Diversity Act	2002	Born out of India's attempt to realize the objectives enshrined in the United Nations Convention on Biological Diversity (CBD) 1992 which recognizes the sovereign rights of states to use their own Biological Resources. The Act aims at the conservation of biological resources

		and associated knowledge as well as facilitating access to them in a sustainable manner and through a just process For purposes of implementing the objects of the Act it establishes the National Biodiversity Authority in Chennai.
Wildlife Conservation Strategy	2002	Broad policy statements regarding protection of wildlife as a national priority, prohibiting conversion of critically important conservation areas, need for forest officers trained on wildlife management, etc.
Wild Life (Protection) Act and amendments	1972 2002 2006	<p>Objective of effectively protecting the wild life of this country and to control poaching, smuggling and illegal trade in wildlife and its derivatives. The Act was amended in January 2003 and punishment and penalty for offences under the Act have been made more stringent. The Ministry has proposed further amendments in the law by introducing more rigid measures to strengthen the Act. The objective is to provide protection to the listed endangered flora and fauna and ecologically important protected areas.</p> <p>The Act provides for two kinds of protection to species—protection of specific endangered species regardless of its location, and the protection of all species in designated PAs.</p>

Source: <http://moef.nic.in>

Appendix K : List of Institutions Affecting Conservation in India

Institution	Responsibility
Ministry of Environment & Forests (MoEF)	The nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programs. The primary concerns of the Ministry are implementation of policies and programs relating to conservation of the country's natural resources including its lakes and rivers, its biodiversity, forests and wildlife, ensuring the welfare of animals, and the prevention and abatement of pollution. Under MoEF there are several organizations that manage specific components of conservation and forestry.
Indian Forest Service	Aims at scientifically managing and protecting the forests of India. It was constituted in the year 1966 under the All India Services Act, 1951 by the Government of India. The main mandate of the service is the implementation of the country's National Forest Policy, which envisages scientific management of forests and to exploit them on a sustained basis for primary timber products, among other things. The responsibility of managing the forests is done by the State Forest Departments under the respective State governments.
Botanical Survey of India (BSI)	<p>The apex research organization under the Ministry of Environment and Forests, Govt. of India for carrying out taxonomic and floristic studies on wild plant resources of the country. It was established in 1890 with the basic objective to explore the plant resources of the country and to identify the plants species with economic virtues. The primary objectives of BSI are as follows:</p> <ul style="list-style-type: none"> • Exploration, inventorying, and documentation of phyto-diversity in general and protected areas, hotspots and fragile ecosystems in particular; publication of National, State and District Floras. • Identification of threatened/red list species and species rich areas needing conservation; ex-situ conservation of critically threatened species in botanical gardens. • Survey and documentation of traditional knowledge (ethno-botany) associated with plants. • Develop a National database of Indian plants, including herbarium and live specimens, botanical paintings/ illustrations, etc.
Zoological Survey of India (ZSI)	Established in 1916, is a pre-eminent research institution under Ministry of Environment and Forests. This institution is tasked with the survey and exploration of faunal resources of the country. The ultimate goal is the taxonomic identification and documentation of the country's biodiversity.

<p>Indian Council of Forestry Research and Education (ICFRE)</p>	<p>Indian Council of Forestry Research and Education (ICFRE), an autonomous organization under the MoEF, is an apex body in the national forestry research system that has been undertaking the holistic development of forestry research through need based planning, promoting, conducting and coordinating research, education and extension covering all aspects of forestry. The Council deals with the solution based forestry research in tune with the emerging issues in the sector, including global concerns such as climate change, conservation of biological diversity, combating desertification and sustainable management and development of resources. The objectives of ICFRE are:</p> <ol style="list-style-type: none"> i. To undertake, aid, promote and coordinate forestry education, research and their applications. ii. To develop and maintain a national library and information centre for forestry and allied sciences. iii. To act as a clearing-house for research and general information related to forests and wildlife. iv. To develop forestry extension programmes and propagate the same through mass media, audio-visual aids and extension machinery. v. To provide consultancy services in the field of forestry research, education and allied sciences. vi. To undertake other jobs considered necessary to attain these objectives. <p>ICFRE has eight Regional Research Institutes and four Research Centres located in different bio-geographical regions of the country to cater the forestry research needs of the nation. The regional research Institutes are located at Dehradun, Coimbatore, Bangalore, Jabalpur, Jorhat, Jodhpur, Shimla and Ranchi and the centres are at Allahabad, Chhindwara, Hyderabad and Aizawl.</p> <p>Research Institutes under the Council are:</p> <ol style="list-style-type: none"> (i) Forest Research Institute (FRI), Dehradun (ii) Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore (iii) Institute of Wood Science and Technology (IWST), Bangalore (iv) Tropical Forest Research Institute (TFRI), Jabalpur (v) Rain Forest Research Institute (RFRI), Jorhat (vi) Arid Forest Research Institute (AFRI), Jodhpur (vii) Himalayan Forest Research Institute (HFRI), Shimla (viii) Institute of Forest Productivity (IFP), Ranchi <p>Advanced research centres under the council are:</p> <ol style="list-style-type: none"> (ix) Centre for Social Forestry and Eco-Rehabilitation (CSFER), Allahabad (x) Centre for Forestry Research and Human Resource Development (CFRHRD), Chhindwara (xi) Forest Research Centre (FRC), Hyderabad (xii) Advanced Research Centre for Bamboo and Rattans (ARCBR), Aizawl
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Forest Survey of India (FSI)	<p>A subordinate office of the Ministry of Environment & Forests, Government of India and is responsible for the national forest resource assessment. Established in 1981, the Forest Survey of India succeeded the “Pre investment Survey of Forest Resources” (PISFR), a project initiated in 1965 by Government of India with the sponsorship of Food and Agriculture Organization (FAO) and United Nations Development Programme (UNDP). The mandate of FSI was revised in 1986 in order to make it more relevant to the rapidly changing needs and aspirations of the country. Major activities of FSI are ‘Forest & Tree Cover Assessment’ and Estimation of Growing Stock of wood within and outside the country’s forests. FSI is also engaged in providing training to state forest department personnel in application of Remote Sensing & Geographical Information System (GIS) in forest resource assessment.</p> <p>The main objectives of FSI are 1) To prepare a comprehensive State of the Forest Report (SFR) including National Vegetation Map (NVM) once every two years. It will also prepare thematic maps through use of remote sensing data with minimum essential ground-truth verification (most ground-truth verification would be done by the respective state governments) on a ten year cycle, and 2) To collect, store and retrieve necessary forestry and forestry-related data for national and state level planning and to create a computer based National Basic Forest Inventory System (NBFIS).</p> <p>FSI assesses forest cover of the country by interpretation of satellite data on a two-year cycle and presents the information in the form of ‘India State of Forest Report’. A new National Forest Inventory (NFI) has been designed and adopted by FSI since 2002. The country has been divided into 14 physiographic zones and 60 districts randomly selected from these zones on probability proportional to size are inventoried in two years. About 8,000 sample plots are laid in forest areas distributed over the country in each cycle for field inventory. It has now been possible to generate a national estimate of growing stock on a two-year cycle.</p>
Wildlife Institute of India (WII)	<p>Established in 1982, is an internationally acclaimed Institution, which offers training program, academic courses and advisory in wildlife research and management. The Institute is actively engaged in research across the breadth of the country on biodiversity related issues. Its mandate is to train government and non-government personnel, carry out research, and advise on matters of conservation and management of wildlife resources.</p>
Ministry of Tribal Affairs	<p>Responsible for implementation of the Forest Rights Act (2006), which seeks to address historic marginalization of tribal communities and clarify tenure of individual and communal claims to forested land.</p>
Ministry of Rural Development	<p>A powerful Ministry, given the size of India’s rural populations and their influence as a strong political constituency. Its mandate is inherently cross-sectoral and integrated under its mandates to accelerate the socio-economic</p>

	development of rural India and focus is on health, education, drinking water, housing and roads. It aligns with biological and forest conservation since it manages the employment guarantee program (conducting public works in forestry, water, natural resource projects) as well as its locational focus on rural areas where resource-dependent rural populations interact with forests for example.
Ministry of Agriculture	Another powerful ministry given the predominantly agricultural-based livelihoods of much of India's population. Agriculture is significant in land and water allocation.
Ministry of Health and Family Welfare	A powerful ministry given the large and growing public resources and its geographic reach. While a secondary driver of conservation issues, the population management components of family planning play important roles potential roles in conservation.
Ministry of New and Renewable Energy	The broad aim of the Ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country. Given the potential greenhouse benefits of renewable energy sources, there is potential for environmental conservation.
Ministry of Water Resources	The Ministry grew out of the subject matters of irrigation for agriculture, flood emergency response, and groundwater exploration. In its modern form, it is responsible for the Nation Water Policy, which establishes policy at the national level. However, since water is generally managed at the state and municipal levels and due to the inherent tension with more powerful Ministries such as Agriculture, the Ministry of Water Resources may be considered a weak ministry with water being managed in a fractured institutional framework.
Ministry of Power	The Ministry of Power is primarily responsible for the development of electrical energy in the country. The Ministry is concerned with perspective planning, policy formulation, processing of projects for investment decision, monitoring of the implementation of power projects, training and manpower development and the administration and enactment of legislation in regard to thermal, hydro power generation, transmission and distribution. It is specifically responsible for rural electrification, with potential linkage with displacement of biomass fuels and possible reduction in pressure on forest resources.

Appendix L : Biodiversity Hotspots in India

Western Ghats

Faced with tremendous population pressure, the forests of the Western Ghats and Sri Lanka have been dramatically impacted by the demands for timber and agricultural land. Remaining forests of the Western Ghats are heavily fragmented; in Sri Lanka, only 1.5 percent of the original forest remains. Population levels are also applying increased stress on the fringes of protected areas where many farms, loggers, and poachers use the resources illegally.

Due in part to the varying effect of the yearly monsoons and the high mountain regions, this hotspot is home to a rich endemic assemblage of plants, reptiles, and amphibians. Sri Lanka alone may be home to as many as 140 endemic species of amphibians. The region also houses important populations of Asian elephants, Indian tigers, and the Endangered lion-tailed macaque. Freshwater fish endemism is extremely high as well, with over 140 native species.



Eastern Himalayas

Eastern Himalaya is situated between Central Nepal in the west to Myanmar in the east, occupying southeast Tibet in China, Sikkim, North Bengal, Bhutan and Northeast India. Eastern Himalaya has a more complex geographical history than the Central Himalaya and has a more varied relief. The Himalaya Hotspot is home to the world's highest mountains, including Mt. Everest. The mountains rise abruptly, resulting in a diversity of ecosystems that range from alluvial grasslands and subtropical broadleaf forests to alpine meadows above the tree line. Vascular plants have even been recorded at more than 6,000 meters. The hotspot is home to important populations of numerous large birds and mammals, including vultures, tigers, elephants, rhinos and wild water buffalo.



Indo-Burma

Encompassing more than 2 million km² of tropical Asia, Indo-Burma is still revealing its biological treasures. Six large mammal species have been discovered in the last 12 years: the large-antlered muntjac, the Annamite muntjac, the grey-shanked douc, the Annamite striped rabbit, the leaf deer, and the saola. This hotspot also holds remarkable endemism in freshwater turtle species, most of which are threatened with extinction, due to over-harvesting and extensive habitat loss. Bird life in Indo-Burma is also incredibly diverse, holding almost 1,300 different bird species, including the threatened white-eared night-heron, the grey-crowned crocias, and the orange-necked partridge.



Appendix M : RDMA 118/119 Analysis (2012): Take-Home Messages Regarding India

The following are our notes submitted by the RDMA 118/119 analysis team that conducted stakeholder meetings in Delhi (Barry Flaming, February 11, 2012).

New and emerging threats:

- **India's emergence as 'the new China.'** With its booming population and economic growth rates, India is set to surpass China as the world's most populous nation by 2030. The rise of India's middle and wealthy classes will have increasingly significant impacts across the Asia region and globally as the nation strives to meet its growing material and energy demands. It will therefore be crucial to strategically engage India in addressing its growing regional and international environmental footprint, particularly around energy, biofuels (India is the world's largest importer of palm oil), water, timber, wildlife, fisheries, and agriculture.
- In particular, increasing demands for energy and water are planned to be met by massive investments in new hydropower development, particularly in the Himalayas. This will result in local and transboundary impacts as well as fragmentation of one of the region's last wilderness frontiers (the eastern Himalayas). In a rush to outcompete China, Indian companies directly fund all hydropower development in Bhutan and purchase resulting electricity.
- An emerging threat may be the growing **commercialization of biodiversity**. The 10th Conference of the Parties to the Convention on Biological Diversity in Japan adopted the *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization* as an international agreement which "aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding, thereby contributing to the conservation of biological diversity and the sustainable use of its components". India appears to be very active on this issue. While it is not clear yet what impact or ramifications this agreement may have, the trends in commercialization are likely to lead to more privatization, patenting, and potential exclusion of local communities from their resources. Research is needed to understand what global implications this trend may have on biodiversity and local peoples.
- **Climate change** is expected to become a significant threat in the medium term, potentially exceeding other threats. *"By 2050 it is expected that climate change will have had a larger impact on river flows than dams and water withdrawals have up to now"* (Doll and Zhang 2010, cited in IUCN 2010). As there is progressively more warming with elevation, areas higher than 4,000 m will experience the greatest warming rates (ICIMOD 2010). This will therefore have disproportionate impacts in alpine and high-elevation areas, including significant impacts in the Himalayas and the Tibetan Plateau, the water tower of Asia.
- **Marine resources:** Pressures on fisheries resources are increasing due to export oriented growth. This has particular impacts on sharks and grouper, as well as aquaculture (tiger prawn). This is compounded by current lack of awareness, capacity, information, and political will on marine issues.

- **Invasive species** are an emerging threat, but there is currently little awareness of the issue or understanding of its potential impacts.

Innovative, successful and/or new approaches:

- The World Bank in India has piloted an innovative approach to incentivize policy reform. They are using a 'policy support loan' in a hill state to assist them in achieving their vision of becoming carbon neutral. The World Bank has agreed to provide a Development Policy Loan after certain policy milestones are reached (e.g. passing of a law, etc.), which would provide resources to help implement the reforms.
- Since most biodiversity lies outside of formally designated protected areas, community conservation areas have emerged as an innovative approach to engage local communities in conservation and strengthen corridors between PAs. A supportive policy environment is needed to empower communities as well as assuring sufficient local benefits. It is essential to address local needs for energy and livelihoods to ensure sustainable conservation and reduce local pressures.
- An NGO in India (NEWS) has been supporting linking science to field implementation through training of local community researchers to collect and generate their own data and information. Training in the use of equipment (salinometers, GPS, Google Earth) is helping them improve their understanding and management of the Sunderbans ecosystem.
- India has initiated a scheme requiring developers to pay an offset for forest conversion, based on a net present value factor, which goes into a government fund (CAFMPA – conservation afforestation .. fund?). The fund now has \$3 B but there are no clear plans to use it. It will likely be disbursed to States and used to fund implementation of forest restoration and afforestation under the Green India Mission program. While they should not be seen as an excuse for pushing through development projects, similar types of offset policies and mechanisms could help generate resources for conservation. Such funds would need to be directly targeted to support environmental protection and restoration.
- The World Bank is engaging with civil engineers on smart green infrastructure design that is sensitive to wildlife migrations.
- IUCN has been engaged in an innovative approach facilitating 'Water Dialogues' (in the Mekong, and between India and Bangladesh) to bring together diverse stakeholders to collectively conduct research and enhance the information available to foster more informed policy dialogue. Such an approach brings science to policy and appears to be an effective way to engage constructively on sensitive policy topics.
- Empowering and networking of local organizations helps strengthen decentralization processes and ensure local access to and benefit from resources.
- India has a strong tradition of tree planting integrated in agricultural lands, which is supported by a robust local small-scale wood processing and handicrafts.

- South Asia Wildlife Enforcement Network (SA-WEN) is developing organically with a thematic focus on marine issues involving relevant countries, and a terrestrial focus involving a different sub-set of countries.
- Providing sufficient incentives for local park rangers, such as giving them life insurance, encourages them to fulfill their high-risk duties.
- Engaging women is a good entry point for capacity building and strengthening community development and local conservation.
- Public-private partnerships and engaging the private sector is a new and innovative field, which is necessary to mainstream environment into business practices, stimulate 'green' business, supply chains and create productive (as opposed to extractive) economic models. Appropriate guidelines for conducting due diligence for partnerships is needed.

RDMA programs and what RDMA can do about the issues and threats mentioned above:

- Strengthen coordination and collaboration with other donors, initiatives, and organizations working regionally. One clear example would be the World Bank's Global Tiger Initiative, and more active involvement and leadership in donor coordination meetings. RDMA should consider how it can better integrate efforts for greater impact, including co-funding collaborative activities and events. This could also consider benefits to bilateral programs and activities.
- Similar to RDMA's approach to engaging China on addressing its transboundary environmental footprint, RDMA should consider a similar approach with India. This could be focused on wildlife trade since we already are engaged in this issue. Other issues could be timber trade, palm oil (for which WWF is already engaged), and hydropower.
- Foster greater linkages between bilateral missions and programs working on similar issues (such as fisheries, climate change adaptation). RDMA could support regional studies that would help inform mission programs in a more cost-effective way.
- RDMA could help facilitate learning and sharing of information between countries, such as through peer-to-peer activities, South-South twinning, and through regional platforms.
- RDMA could help support coordinated engagement with USG technical agencies such as USFWS, USFS, NOAA, DOJ, DOI, etc. This could perhaps be through consideration of a broader interagency mechanism that engages multiple relevant agencies in a more coordinated fashion.
- RDMA could help promote broader cross-regional sharing between Mekong countries and South Asia on wildlife trade, hydropower, transboundary water, forestry/REDD+, fisheries, biodiversity conservation, etc. This could be through networking of existing regional platforms (e.g. SA-WEN and ASEAN-WEN, CTI and Bay of Bengal, ASEAN and SAARC, etc.) and governments.

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